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REPORT

OF THE

TESTS OF METALS

AND OTHER MATERIALS

FOR

INDUSTRIAL PURPOSES

MADE WITH THE

UNITED STATES TESTING MACHINE AT WATERTOWN ARSENAL, MASSACHUSETTS, DURING THE FISCAL YEAR ENDED JUNE 30,

1907.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1908.

WAR DEPARTMENT,

Document No. 307.

Office of the Chief of Staff.

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WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ORDNANCE,
Washington, April 4, 1908.

SIR: I have the honor to submit, for transmission to Congress, as required by law, a copy of the report of the commanding officer of Watertown Arsenal, of Tests of Iron and Steel and other Material for Industrial Purposes, made at that arsenal during the fiscal year ended June 30, 1907 (O. O. File 18563).

Very respectfully,

WILLIAM CROZIER,
Brig. Gen., Chief of Ordnance.

The honorable the SECRETARY OF WAR.

WAR DEPARTMENT,
Washington, April 6, 1908.

SIR: I have the honor to transmit herewith a letter from the Chief of Ordnance, U. S. Army, dated 4th instant, submitting, for transmission to Congress, as required by law, copy of the report of the commanding officer of Watertown Arsenal, of Tests of Iron and Steel and other Material for Industrial Purposes, made at that arsenal during the fiscal year ended June 30, 1907.

Very respectfully,

ROBERT SHAW OLIVER,
Acting Secretary of War.

The SPEAKER OF THE HOUSE OF REPRESENTATIVES.

WATERTOWN ARSENAL,
Watertown, Mass., November 1, 1907.

SIR: I have the honor to submit herewith the annual report of tests of iron and steel and other materials made at this arsenal during the fiscal year ended June 30, 1907.

The total number of specimens tested during the year was classified as follows:

Gun specimens	51
For Ordnance Department	1,930
For other Government departments	50
Investigative tests	530
Tests for private parties	978
Total	3,539

The receipts and expenditures were as follows:

Amount appropriated for testing machine and testing work	$15,000.00
Amount received for same	14,282.31
Received from private parties	1,084.10
Total received	15,366.41
Amount expended for services and labor	11,935.82
Amount expended for light, power, tools, implements, and materials for test	3,426.32
Deposited to credit of Treasurer of United States	4.27
Total expended	15,366.41

Tests on material representing the current work of the Ordnance Department are included in the first part of this report, followed by tests on constructive material for general engineering purposes in the latter part.

The departmental tests comprise those of an investigative nature and such other as seem desirable to embody in the report for record and for reference purposes. Many tests of a routine character were made during the year, the aggregate number of tests being stated above, but the detailed tests are omitted from the report. Tests are required for the acceptance of material, the results of which not infrequently cease to be of interest when it has been ascertained that the prescribed physical properties are or are not possessed by the material. Tests of this kind have been omitted.

Among the departmental tests may be mentioned some mandrel tests of steel rings taken from the tubes and jackets of 3-inch and 4.7-inch guns. The display of elongation of the metal in these rings, for metal structurally sound, shows higher values than experienced in the direct tensile tests of the steel.

In the frictional resistance tests of copper band metal on steel, high pressures were applied to the contact surfaces, to represent the pressures reached by the metal of the bands of projectiles in the gun under service conditions of firing.

There was a series of tests on cylinders for use in pressure gauges for determination of powder pressures in guns. This series comprised cylinders of copper and of gilding metal, the latter being an alloy of which copper is the principal constituent. There were also tests on lead cylinders of corresponding dimensions to those of copper used in pressure gauges. The long-continued flow of the lead under certain constant loads, unfitting this metal for pressure gauge purposes, is well shown in the tests.

For purposes of record a statement is made of the proof stresses which were applied to piston rods, wire ropes, and chains used in gun carriage construction.

Additional tests of wheels for field carriages and limbers were carried out, supplementing those of the report of the previous year.

Tests have been continued on the endurance of steels under repeated alternate stresses of tension and compression.

Further tests were made upon neat cements which have been kept at low temperatures for a term of years, the material having been exposed to zero Fahrenheit temperature soon after gauging, and maintained at this temperature until about the time of testing.

The series of concrete columns, plain and reenforced with longitudinal bars and by means of external hooping or steel wire helixes, inaugurated in 1904, are represented in the tests herein. Attention is invited to the reprinting herein of certain tables on deduced results on concrete column tests, recorded in reports of 1904 and 1905. Errors were found in the original tables, which the reprint is intended to correct. There are also tests of brick and brick piers, and a number of tests of building stone.

A series of diagrams is presented showing the temperatures acquired at the centers of some 12-inch cubes of neat Portland cement while setting. A decided rise in temperature characterizes each brand of cement represented. The temperature at the center of the cube advances slowly for a number of hours immediately after gauging, then increasing in its rate until the maximum temperature is nearly reached. After passing the maximum the temperature gradually drops, but remains above that of the room for a period exceeding a day.

A list of private parties who have had tests made on their individual account, in accordance with a provision of the law, is appended.

Acknowledgment is due the services of Mr. J. E. Howard, C. E., under whose direct supervision and charge the work of the laboratory has been conducted.

Very respectfully, your obedient servant,

C. L'H. RUGGLES,
Major, Ordnance Department, U. S. Army, Commanding.

The CHIEF OF ORDNANCE, U. S. ARMY,
Washington, D. C.

TABLE OF CONTENTS.

		Page.
1.	3-inch and 4.7-inch tubes and jackets, mandrel tests	11
2.	Shot and shell	19
3.	Steel for comparison of testing machines	23
4.	Miscellaneous steels—tensile and bending tests and chemical analyses	39
5.	Steel wire	43
6.	Curb bits and stirrups	47
7.	Monel metal	51
8.	Frictional resistance tests of copper band-metal	61
9.	Copper cylinders for pressure gauges	71
10.	Lead cylinders	85
11.	Chemical analyses	90
12.	Proof stresses	90
13.	Wheels for field carriages and limbers	91
14.	Cordage	103
15.	12-inch naval gun No. 36	107
16.	Railroad material	109
17.	Endurance of rotating shafts	117
18.	Cement, temperatures of while setting	127
19.	Cement, tests after setting at different temperatures and long-time tests	131
20.	Concrete and mortar columns	143
21.	Steel bars used in concrete construction	259
22.	Concrete piles	263
23.	Brick, tile, and partition blocks	267
24.	Brick piers	291
25.	Wooden posts	353
26.	Rubber belting	357
27.	Stone, miscellaneous	361
28.	Blue-print and brown-print paper	371
29.	Private tests	374

REPORT

OF THE

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1907.

MANDREL TESTS.

3-INCH AND 4.7-INCH TUBES AND JACKETS.

MANDREL TESTS.

RINGS FROM 3-INCH AND 4.7-INCH TUBES AND JACKETS.

The extension of the metal, at the bore, of rings taken from steel forgings for the tubes and jackets of 3-inch and 4.7-inch guns, was determined in the mandrel test by the use of short rings ranging from ".92 to 1".82 in length. The rings were prepared for testing by facing the ends by smooth cuts in the lathe, and by turning the surface of the bore slightly conical to fit the taper of the mandrel.

The mandrels were made with a taper of ".04 per inch, and when in use were lubricated with a mixture of grease and plumbago.

The tabular results give the distinguishing marks of the forgings, the original dimensions of the rings as prepared for testing, and the measurements of the bore after the test and rupture of the metal, together with the amount of extension stated in inches and also in percentage of the original circumferential length. A description of the fractured surfaces is given in the last column of the tables, and mention made of the place at which rupture began, whether at or near the surface of the bore or exterior surface of the rings.

Marks.	Original dimensions.				Circumference of bore after test.	Extension of metal at bore.		Fracture.
	Length.	Exterior diameter.	Interior diameter.	Circumference of bore.				
	In.	*In.*	*In.*	*In.*	*In.*	*In.*	*Perct.*	
65304B1-126	1.46	7.34	4.97	15.61	18.95	3.34	21.4	Started at inside corner. Fine granular.
67350B2-3R131J	1.46	7.57	4.97	15.61	19.46	3.85	24.7	Do.
58043B1-3-133	1.46	7.42	4.97	15.61	19.40	3.79	24.3	Started at inside corner. Lamellar, 20 per cent; fine granular, 80 per cent.
37349B2-3R129J	1.46	7.61	4.97	15.61	19.95	4.34	27.8	Started at inside. Lamellar, 30 per cent; fine granular, 70 per cent.
67527B1-3-130	1.46	7.58	4.97	15.61	18.90	3.29	21.1	Started at inside corner. Fine granular.
67350B3-128	1.46	7.61	4.97	15.61	18.94	3.33	21.3	Do.
3-132	1.46	7.54	4.97	15.61	18.76	3.15	20.2	Started at outside. Fine granular.
64802B24-3R124J	1.50	7.62	4.98	15.65	20.07	4.42	28.2	Started at inside. Fine granular.
64574B3-127J	1.50	7.56	4.98	15.65	19.26	3.61	23.1	Started at inside corner. Fine granular.
66765B2-3R125J	1.50	7.59	4.98	15.65	20.00	4.35	27.8	Started at inside. Fine granular.
64574B1	1.28	7.64	4.97	15.61	17.38	1.77	11.3	Started at outside. Granular.
66646B3	1.26	7.68	4.97	15.61	18.92	3.31	21.2	Started near bore. Granular.
65304B2	1.26	7.70	4.97	15.61	17.84	2.23	14.3	Started at bore. Granular.
65305B3	1.26	7.66	4.97	15.61	19.00	3.39	21.7	Started near bore. Granular.
64573B3	1.22	7.71	4.97	15.61	18.60	2.99	19.2	Started at outside corner. Granular, flaky.
64802B3	1.21	7.66	4.97	15.61	19.87	4.26	27.3	Started at outside. Granular.
66646B1	1.28	7.66	4.97	15.61	19.15	3.54	22.7	Granular.
67528B2-140	1.65	7.56	4.98	15.65	19.05	3.40	21.7	Do.
66766B3-145	1.37	7.54	4.98	15.65	19.20	3.55	22.7	Do.
67349B3-139	1.38	7.56	4.98	15.65	18.80	3.15	20.1	Do.
66766B2-134	1.31	7.56	4.98	15.65	20.00	4.35	27.8	Started near bore. Granular.
66877B1-136	1.48	7.58	4.98	15.65	18.62	2.97	19.0	Do.
66544B2-141	1.59	7.59	4.98	15.65	18.52	2.87	18.3	Started at outside. Granular.
66766B1-144	1.58	7.62	4.98	15.65	18.85	3.20	20.4	Started near bore. Granular.

Marks.	Original dimensions.				Circumference of bore after test.	Extension of metal at bore.		Fracture.
	Length.	Exterior diameter.	Interior diameter.	Circumference of bore.				
	In.	*In.*	*In.*	*In.*	*In.*	*In.*	*Perct.*	
67528B1–135	1.55	7.49	4.98	15.65	19.95	4.30	27.5	Started at outside. Granular.
65305B2–138	1.56	7.50	4.98	15.65	18.30	2.65	16.9	Granular. Irregular near bore.
3R142T	1.19	5.43	2.95	9.27	11.77	2.50	26.9	Started at inside. Lamellar, 30 per cent; fine granular, 70 per cent.
3R140T	1.19	5.33	2.95	9.27	12.45	3.18	34.3	Silky at bore, granular beyond.
3R135T	1.19	5.46	2.95	9.27	12.75	3.48	37.5	Do.
3R139T	1.19	5.45	2.95	9.27	11.68	2.41	26.0	Silky; lamellar.
3R137T	1.19	5.46	2.95	9.27	12.24	2.97	32.0	Started at outside. Granular.
3R143T	1.19	5.40	2.95	9.27	12.18	2.91	31.4	Started at outside corner. Granular.
3R141T	1.19	5.45	2.95	9.27	10.60	1.33	14.3	Do.
3R138T	1.19	5.44	2.95	9.27	12.32	3.05	32.9	Granular; silky section at bore.
3R136T	1.19	5.45	2.95	9.27	12.10	2.83	30.5	Started at outside. Granular.
131T	1.17	5.46	2.95	9.27	12.02	2.75	29.7	Started at outside corner. Granular.
3R132T	1.17	5.47	2.95	9.27	12.08	2.81	30.3	Granular; in part smooth, oblique.
103T	1.17	5.44	2.95	9.27	12.72	3.45	37.2	Granular; smooth section.
134T45	1.17	5.43	2.95	9.27	9.48	.21	2.3	Started at outside. Granular; lamellar streak.
129T	1.17	5.42	2.95	9.27	12.42	3.15	34.0	Started at outside. Granular.
133T44	1.17	5.46	2.95	9.27	12.02	2.75	29.7	Started at outside corner. Granular.
3R127T	1.17	5.31	2.95	9.27	12.47	3.20	34.5	Silky, oblique.
128T	1.17	5.44	2.95	9.27	11.52	2.25	24.3	Started at outside corner. Granular.
3R144T	1.20	5.32	2.95	9.27	12.18	2.91	31.4	Silky at bore; granular beyond.
3R153T	1.17	5.43	2.95	9.27	10.35	1.08	11.7	Started at outside. Granular.
3R152T	1.16	5.42	2.95	9.27	11.93	2.66	28.7	Granular.
3R146T	1.19	5.32	2.95	9.27	12.42	3.15	34.0	Granular, 50 per cent; silky, 50 per cent.
3R149T	1.22	5.51	2.95	9.27	12.55	3.28	35.4	Granular.
3R148T	1.20	5.33	2.95	9.27	12.05	2.78	30.0	Do.
3R147T	1.15	5.46	2.95	9.27	12.50	3.23	34.8	Granular; silky at bore.
3R150T	1.22	5.47	2.95	9.27	12.31	3.04	32.8	Granular.
3R151T	1.21	5.42	2.95	9.27	11.98	2.71	29.2	Do.
3R145T	1.21	5.37	2.95	9.27	11.60	2.33	25.1	Started at outside corner. Granular.
49928B2	1.24	5.35	2.95	9.27	12.40	3.13	33.8	Started at outside. Granular.
49931B2	1.27	5.33	2.95	9.27	10.20	.93	10.0	Silky at bore, granular beyond.
64764B1	1.33	5.32	2.95	9.27	12.65	3.38	36.5	Started at outside. Granular.
64868B2	1.21	5.36	2.95	9.27	10.32	1.05	11.3	Granular.
64867B2	1.24	5.32	2.95	9.27	12.50	3.23	34.8	Granular and lamellar.
66646B2–150	1.44	7.59	4.97	15.61	18.30	2.69	17.2	Started at inside. Granular.
64573B2–147	1.82	7.55	4.97	15.61	19.55	3.94	25.2	Fractured in 2 places; both started at inside. Granular.
67051B1–146	1.72	7.60	4.97	15.61	18.35	2.74	17.6	Started at outside. Granular.
66877B2–149	1.53	7.52	4.97	15.61	18.82	3.21	20.6	Do.
64803B2–152	1.45	7.58	4.97	15.61	20.02	4.41	28.3	Fractured in 2 places; 1 started at inside, 1 at outside. Granular.
65305B1–151	1.54	7.54	4.97	15.61	19.66	4.05	25.9	Started at inside. Granular, 80 per cent; lamellar, 20 per cent.
67051B3–143	1.57	7.54	4.97	15.61	18.55	2.94	18.8	Started at outside. Granular.

Marks.	Original dimensions.				Circumference of bore after test.	Extension of metal at bore.		Fracture.
	Length.	Exterior diameter.	Interior diameter.	Circumference of bore.				
	In.	*In.*	*In.*	*In.*	*In.*	*In.*	*Perct.*	
66543B2-154	1.57	7.55	4.97	15.61	18.40	2.79	17.9	Started at inside. Granular, 80 per cent; lamellar, 20 per cent.
70387B1-156	1.46	7.52	4.97	15.61	18.80	3.19	20.4	Do.
66647B2-137	1.48	7.61	4.97	15.61	19.52	3.91	25.0	Started at outside. Granular.
66543B1-153	1.35	7.58	4.97	15.61	19.02	3.41	218	Started at inside. Granular, 70 per cent; lamellar, 30 per cent.
66455B2-157	1.54	7.55	4.97	15.61	20.15	4.54	29.1	Started at inside. Granular.
66658B2-3R155T	1.17	5.45	2.98	9.36	11.80	2.44	26.1	Started at inside. Silky, 80 per cent; granular, 20 per cent.
66653B1-3R156T	1.21	5.46	2.98	9.36	11.92	2.56	27.4	Started at outside. Granular.
64876B2-3R154T	1.22	5.47	2.98	9.36	12.62	3.26	34.8	Started at inside. Silky, 50 per cent; granular, 50 per cent.
64871B1-3R157T	1.24	5.34	2.98	9.36	12.48	3.12	33.3	Started at inside. Granular.
66543B3-155	1.48	7.56	4.97	15.61	19.15	3.54	22.7	Started at outside. Granular.
B168J	1.25	7.78	6.00	18.85	22.08	3.23	17.1	Started at outside. Fine granular.
M2J	1.21	7.64	6.00	18.85	20.02	1.17	6.2	Started at side. Granular.
M4J	1.15	7.58	6.00	18.85	21.55	2.70	14.3	Started at outside. Fine granular.
B167J	1.09	7.79	6.00	18.85	22.14	3.29	17.5	Do.
M5J	1.21	7.50	6.00	18.85	21.85	3.00	15.9	Do.
M3J	1.20	7.61	6.00	18.85	19.60	.75	4.0	Started at outside. Granular.
M1J	1.18	7.63	6.00	18.85	21.50	2.65	14.1	Started at outside. Fine granular.
M6J	1.19	7.65	6.00	18.85	20.18	1.33	7.1	Started at inside. Granular.
M18J	1.14	7.57	6.00	18.85	19.62	.77	4.1	Started at outside. Granular, 70 per cent; lamellar, 30 per cent.
B169J	1.19	7.80	6.00	18.85	21.48	2.63	14.0	Started at outside. Fine granular.
M13J	1.19	7.52	6.00	18.85	21.20	2.35	12.5	Do.
B170J	.97	7.70	6.00	18.85	20.50	1.65	8.8	Do.
M21J	1.25	7.60	6.00	18.85	21.76	2.91	15.4	Do.
M15J	1.23	7.60	6.00	18.85	21.90	3.05	16.2	Do.
M12J	1.23	7.60	6.00	18.85	21.83	2.98	15.8	Do.
3R148JB	1.54	7.56	4.98	15.65	18.88	3.23	20.6	Started at inside. Granular.
3R130JB	1.48	7.49	4.98	15.65	18.92	3.27	20.9	Started at outside. Granular.
3R150JB	1.63	7.48	4.98	15.65	18.59	2.94	18.8	Do.
3RF4TV-7363B-M4T	1.24	6.80	2.95	9.27	13.12	3.85	41.5	Started at inside. Silky, 60 per cent; granular, 40 per cent.
M17T	1.21	6.78	2.95	9.27	11.20	1.93	20.8	Started at outside. Granular.
3RFG167T-B167T	1.19	6.79	2.95	9.27	13.15	3.88	41.9	Started at inside. Silky, 80 per cent; granular, 20 per cent.
M2T	1.23	6.76	2.95	9.27	12.70	3.43	37.0	Started at outside; 5 cracks outside. Granular.
M1T	1.24	6.79	2.95	9.27	11.78	2.51	27.1	Started at outside. Granular.
68484B2-3R142T	1.20	5.38	2.95	9.27	11.72	2.45	26.4	Started at silky spot at outside. Granular.
68482B1-3RFG-143T	1.20	5.38	2.95	9.27	9.65	.38	4.1	Started at silky spot at inside. Silky, 60 per cent; granular, 40 per cent.
17J	1.62	7.55	4.97	15.61	19.25	3.64	23.3	Started at outside. Fine granular.
19J	1.44	7.61	4.97	15.61	19.25	3.64	23.3	Do.

Marks.	Original dimensions.				Circumference of bore after test.	Extension of metal at bore.		Fracture.
	Length.	Exterior diameter.	Interior diameter.	Circumference of bore.				
	In.	*In.*	*In.*	*In.*	*In.*	*In.*	*Perct.*	
20J	1.60	7.50	4.97	15.61	18.60	2.99	19.2	Started at inside. Fine granular, 70 per cent; lamellar, 30 per cent.
21J	1.48	7.55	4.97	15.61	19.30	3.69	23.6	Started at inside. Fine granular.
23J	1.61	7.50	4.97	15.61	19.10	3.49	22.4	Do.
24J	1.47	7.53	4.97	15.61	18.94	3.33	21.3	Started at inside. Fine granular, 80 per cent; lamellar, 20 per cent.
25J	1.41	7.54	4.97	15.61	19.82	4.21	27.0	Fractured in 2 places, both inside. Both fractures granular.
26J	1.46	7.56	4.97	15.61	20.10	4.49	28.8	Started at inside. Fine granular, 80 per cent; lamellar, 20 per cent.
27J	1.49	7.54	4.97	15.61	18.65	3.04	19.5	Started at inside. Fine granular.
28J	1.58	7.50	4.97	15.61	19.17	3.56	22.8	Do.
29J	1.58	7.50	4.97	15.61	19.36	3.75	24.0	Started at outside. Fine granular.
30J	1.57	7.52	4.97	15.61	18.95	3.34	21.4	Started at inside. Fine granular, 80 per cent; lamellar, 20 per cent.
31J	1.34	7.55	4.97	15.61	18.17	2.56	16.4	Started at outside. Fine granular.
32J	1.57	7.55	4.97	15.61	18.05	2.44	15.6	Do.
33J	1.46	7.66	4.97	15.61	19.35	3.74	24.0	Started at inside. Fine granular.
34J	1.54	7.62	4.97	15.61	18.90	3.29	21.1	Started at inside. Fine granular, 80 per cent; lamellar, 20 per cent.
35J	1.66	7.67	4.97	15.61	19.38	3.77	24.2	Started at outside. Fine granular.
36J	1.56	7.52	4.97	15.61	17.18	1.57	10.1	Started at inside. Fine granular.
37J	1.58	7.62	4.97	15.61	18.78	3.17	20.3	Started at outside. Fine granular.
39J	1.40	7.53	4.97	15.61	18.88	3.27	20.9	Do.
43J	1.49	7.69	4.97	15.61	19.90	4.29	27.5	Started at inside. Fine granular.
48J	1.50	7.52	4.97	15.61	19.30	3.69	23.6	Fractured in 2 places, both starting inside. Both fractures granular.
51J	1.48	7.62	4.97	15.61	19.88	4.27	27.4	Started at outside. Fine granular, 70 per cent; lamellar, 30 per cent.
B130J	1.46	7.26	4.97	15.61	20.05	4.44	28.4	Fractured in 2 places, both starting inside. Both fractures granular.
B148J	1.58	7.58	4.97	15.61	19.00	3.39	21.7	Started at inside. Fine granular.
70750B1	1.19	7.65	4.97	15.61	17.80	2.19	14.0	Started at a lamellar spot ¼ inch from outside. Fine granular.
70751B1	1.22	7.62	4.97	15.61	19.17	3.56	22.8	Started at outside. Fine granular.
70388B2	1.15	7.65	4.97	15.61	18.32	2.71	17.4	Do.
70388B3	1.17	7.63	4.97	15.61	17.85	2.24	14.3	Do.
73707B2	1.21	7.66	4.97	15.61	19.85	4.24	27.2	Started at inside. Fine granular.
73707B3	1.18	7.64	4.97	15.61	17.00	1.39	8.9	Started at outside. Fine granular.
73708B1	1.21	7.61	4.97	15.61	19.40	3.79	24.3	Started at inside. Fine granular.
73708B2	1.23	7.64	4.97	15.61	17.55	1.94	12.4	Started at outside. Fine granular.
73708B3	1.19	7.65	4.97	15.61	19.05	3.44	22.0	Do.
73241B2	1.21	7.65	4.97	15.61	20.86	5.25	33.6	Do.
73241B3	1.14	7.62	4.97	15.61	18.25	2.64	16.9	Do.
73242B1	1.17	7.64	4.97	15.61	19.35	3.74	24.0	Started at inside. Fine granular.

Marks.	Original dimensions.				Circumference of bore after test.	Extension of metal at bore.		Fracture.
	Length.	Exterior diameter.	Interior diameter.	Circumference of bore.				
	In.	*In.*	*In.*	*In.*	*In.*	*In.*	*Perct.*	
73243B2	1.21	7.61	4.97	15.61	19.08	3.47	22.2	Started at outside. Fine granular.
73244B1	1.25	7.66	4.97	15.61	17.55	1.94	12.4	Do.
73244B3	1.21	7.63	4.97	15.61	17.80	2.19	14.0	Do.
68485B1	1.24	5.34	2.90	9.11	12.30	3.19	35.0	Started at inside. Silky; oblique.
68496B2	1.21	5.38	2.90	9.11	12.00	2.89	31.7	Started at outside. Silky.
68486B2	1.20	5.34	2.90	9.11	10.58	1.47	16.1	Started at outside. Fine granular.
68493B2	1.23	5.36	2.90	9.11	11.98	2.87	31.5	Started at outside. Silky.
68494B2	1.22	5.40	2.90	9.11	12.12	3.01	33.0	Started at inside. Silky; oblique.
68495B1	1.19	5.42	2.90	9.11	11.90	2.79	30.6	Started at outside. Fine granular.
18T	1.20	5.28	2.90	9.11	12.35	3.24	35.6	Started at inside. Silky; oblique.
19T	1.18	5.32	2.90	9.11	12.00	2.89	31.7	Started at outside. Fine granular.
21T	1.19	5.34	2.90	9.11	11.85	2.74	30.1	Started at outside. Silky.
22T	1.22	5.29	2.90	9.11	12.45	3.34	36.7	Broke in 2 places; 1 started at inside and 1 at outside. Both granular.
23T	1.19	5.29	2.90	9.11	11.82	2.71	29.7	Started at outside. Silky.
24T	1.24	5.34	2.90	9.11	11.94	2.83	31.1	Do.
25T	1.17	5.33	2.90	9.11	11.32	2.21	24.3	Started at outside. Fine granular.
26T	1.21	5.33	2.90	9.11	11.48	2.37	26.0	Do.
28T	1.19	5.26	2.90	9.11	12.58	3.47	38.1	Do.
32T	1.20	5.30	2.90	9.11	11.89	2.78	30.5	Do.
33T	1.23	5.31	2.90	9.11	12.10	2.99	32.8	Started at inside. Silky; oblique.
34T	1.20	5.33	2.90	9.11	12.09	2.98	32.7	Started at inside. Granular, 70 per cent; lamellar, 30 per cent.
35T	1.19	5.36	2.90	9.11	11.42	2.31	25.4	Started at outside. Fine granular.
36T	1.22	5.36	2.90	9.11	12.48	3.37	37.0	Started at inside. Fine granular.
37T	1.22	5.26	2.90	9.11	11.35	2.24	24.6	Started at outside. Fine granular.
38T	1.20	5.36	2.90	9.11	11.34	2.23	24.5	Do.
40T	1.19	5.34	2.90	9.11	12.70	3.59	39.4	Started at inside. Fine granular.
41T	1.21	5.32	2.90	9.11	10.04	.93	10.2	Started at outside. Fine granular.
42T	1.21	5.35	2.90	9.11	12.01	2.90	31.8	Do.
45T	1.23	5.31	2.90	9.11	11.05	1.94	21.3	Started at inside. Granular, 50 per cent; lamellar, 50 per cent.
46T	1.20	5.34	2.90	9.11	12.91	3.80	41.7	Started at inside. Silky.
49T	1.23	5.31	2.90	9.11	11.53	2.47	27.1	Started at outside. Silky.
50T	1.16	5.33	2.90	9.11	12.52	3.41	37.4	Started at outside. Fine granular.
51T	1.17	5.30	2.90	9.11	12.50	3.39	37.2	Do.
52T	1.18	5.33	2.90	9.11	12.10	2.99	32.8	Started at inside. Silky; oblique.
55T	1.17	5.26	2.90	9.11	12.50	3.39	37.2	Started at outside. Fine granular.
56T	1.19	5.29	2.90	9.11	12.35	3.24	35.6	Started at outside. Fine granular, 70 per cent; lamellar, 30 per cent.
M7J	1.21	7.48	6.00	18.85	22.10	3.25	17.2	Started at outside. Fine granular.
M8J	1.22	7.51	6.00	18.85	22.26	3.41	18.1	Do.
M9J	1.18	7.54	6.00	18.85	20.03	1.18	6.3	Do.
M10J	1.22	7.57	6.00	18.85	21.68	2.83	15.0	Do.
M11J	1.22	7.60	6.00	18.85	20.40	1.55	8.2	Do.
M14J	1.24	7.57	6.00	18.85	19.05	.20	1.1	Do.
16J	1.43	7.56	6.00	18.85	19.55	.70	3.7	Do.
M17J	1.22	7.57	6.00	18.85	21.85	3.00	15.9	Do.
M19J	1.22	7.52	6.00	18.85	21.18	2.33	12.4	Do.
M20J	1.28	7.52	6.00	18.85	19.98	1.13	6.0	Do.
M22J	1.24	7.50	6.00	18.85	22.02	3.17	16.8	Do.
M23J	1.14	7.53	6.00	18.85	20.70	1.85	9.8	Do.

Marks.	Original dimensions.				Circumference of bore after test.	Extension of metal at bore.		Fracture.
	Length.	Exterior diameter.	Interior diameter.	Circumference of bore.				
	In.	*In.*	*In.*	*In.*	*In.*	*In.*	*Perct.*	
B171J	1.24	7.67	6.00	18.85	21.90	3.05	16.2	Started at center. Fine granular, 50 per cent; lamellar, 50 per cent.
172J	1.40	7.70	6.00	18.85	21.05	2.20	11.7	Started at outside. Fine granular.
173J	1.44	7.75	6.00	18.85	21.90	3.05	16.2	Started at inside. Fine granular.
174J	1.36	7.72	6.00	18.85	20.55	1.70	9.0	Started at outside. Fine granular.
175J	1.22	7.79	6.00	18.85	21.00	2.15	11.4	Do.
38J	1.62	7.51	4.97	15.61	16.88	1.27	8.1	Started at lamellar streak 1".40x".10. Granular.
40J	1.60	7.63	4.97	15.61	17.95	2.34	15.0	Started at outside. Granular.
41J	1.60	7.60	4.97	15.61	19.08	3.47	22.2	Started at inside. Granular, 80 per cent; lamellar, 20 per cent.
42J	1.56	7.52	4.97	15.61	19.03	3.42	21.9	Started at outside. Granular.
44J	1.54	7.44	4.97	15.61	18.50	2.89	18.5	Started at inside. Granular.
45	1.58	7.46	4.97	15.61	19.85	4.24	27.2	Started at center. Granular, 60 per cent; lamellar, 40 per cent.
46J	1.52	7.52	4.97	15.61	19.61	4.00	25.6	Started at inside. Granular.
47J	1.73	7.52	4.97	15.61	19.43	3.82	24.5	Started at inside. Granular, 80 per cent; lamellar, 20 per cent.
49J	1.55	7.53	4.97	15.61	19.82	4.21	27.0	Started at inside. Granular.
50J	1.62	7.50	4.97	15.61	19.35	3.74	24.0	Do.
3RF-176J	.95	7.68	6.00	18.85	21.10	2.25	11.9	Started at outside. Granular.
3RF-177J	1.12	7.68	6.00	18.85	21.65	2.80	14.9	Do.
3RFG-178J	.99	7.76	6.00	18.85	21.15	2.30	12.2	Started at inside. Granular.
4.7-1T	1.22	8.04	4.97	15.61	18.48	2.87	18.4	Started at outside. Granular.
4.7-2T	1.22	8.04	4.97	15.61	16.26	.65	4.2	Started at outside. Fine granular.
4.7-3T	1.23	8.02	4.97	15.61	18.59	2.98	19.1	Do.
4.7-4T	1.23	8.02	4.97	15.61	18.70	3.09	19.8	Started at outside. Granular.
18J	1.62	7.56	4.97	15.61	17.13	1.52	9.7	Started at lamellar streak at outside. Fine granular.
22J	1.64	7.54	4.97	15.61	19.05	3.44	22.0	Started at smooth spot at center. Fine granular.
52J	1.73	7.47	4.97	15.61	19.07	3.46	22.2	Started at lamellar spot at inside. Fine granular.
53J	1.42	7.52	4.97	15.61	19.50	3.89	24.9	Started at inside. Lamellar, 25 per cent; fine granular, 75 per cent.
54J	1.63	7.48	4.97	15.61	19.38	3.77	24.2	Started at inside. Fine granular.
55J	1.62	7.52	4.97	15.61	20.03	4.42	28.3	Started at inside. Lamellar, 30 per cent fine granular, 70 per cent.
56J	1.54	7.53	4.97	15.61	19.31	3.70	23.7	Started at inside. Fine granular.
3RFG-181JB	.92	7.71	6.00	18.85	21.10	2.25	11.9	Started at outside, at silky spot. Fine granular.
3RFG-182J	.99	7.73	6.00	18.85	21.50	2.65	14.1	Do.
20T	1.23	5.24	2.90	9.11	14.17	5.06	55.5	Started at inside. Fine granular.
3RFG-179J	.93	7.70	6.00	18.85	22.04	3.19	16.9	Started at outside. Fine granular.
3RFG-180J	.97	7.70	6.00	18.85	20.10	1.25	6.6	Started at center. Granular, 40 per cent; silky, 60 per cent.
183J	1.14	8.42	6.00	18.85	19.25	.40	2.1	Started at inside. Granular.

Marks.	Original dimensions.				Circumference of bore after test.	Extension of metal at bore.		Fracture.
	Length.	Exterior diameter.	Interior diameter.	Circumference of bore.				
	In.	*In.*	*In.*	*In.*	*In.*	*In.*	*Perct.*	
B184J	0.98	8.30	6.00	18.85	21.12	2.27	12.0	Started at inside. Granular; flaky spot at center.
B185J	1.18	7.65	6.00	18.85	20.32	1.47	7.8	Started at center. Granular.
B186J	1.21	8.34	6.00	18.85	20.57	1.72	9.1	Started at outside. Granular.
B187J	1.23	7.67	6.00	18.85	21.10	2.25	11.9	Started at center. Silky.
B188J	1.11	7.68	6.00	18.85	22.45	3.60	19.1	Do.
B189J	1.10	8.31	6.00	18.85	21.72	2.87	15.2	Started at outside. Silky.
M28	1.64	7.55	4.97	15.61	19.60	3.99	25.6	Started at outside. Granular.
M57J	1.60	7.59	4.97	15.61	19.53	3.92	25.1	Do.
64868B1	1.25	5.32	2.95	9.27	12.26	2.99	32.2	Started at inside. Silky.
68483B2F1	1.24	5.35	2.95	9.27	12.16	2.89	31.1	Do.
66666B2	1.27	5.34	2.95	9.27	11.98	2.71	29.2	Started at inside. Fine granular.
66654B1	1.24	5.36	2.95	9.27	12.70	3.43	37.0	Started at inside. Silky.
68480B2	1.26	5.35	2.95	9.27	11.92	2.65	28.5	Started at outside. Fine granular.
66659B2	1.26	5.33	2.95	9.27	11.22	1.95	21.0	Do.
64877B1	1.24	5.32	2.95	9.27	12.04	2.77	29.8	Started at inside. Lamellar.
66662B1	1.30	5.31	2.95	9.27	13.06	3.79	40.9	Started at inside. Fine granular.
68485B2	1.25	5.43	2.95	9.27	11.00	1.73	18.6	Started at outside. Fine granular.
66654B2	1.23	5.33	2.95	9.27	10.95	1.68	18.1	Do.
49931B1	1.27	5.35	2.95	9.27	12.30	3.03	32.6	Started at inside. Silky.
66652B1	1.26	5.35	2.95	9.27	12.35	3.08	33.2	Started at outside. Fine granular.
68481B2	1.24	5.32	2.95	9.27	11.60	2.33	25.1	Do.
68483B1	1.25	5.36	2.95	9.27	12.05	2.78	29.9	Started at inside. Lamellar, 20 per cent; granular, 80 per cent.
64873B1	1.21	5.34	2.95	9.27	12.72	3.45	37.2	Started at inside. Fine granular; oblique.
68480B1	1.25	5.39	2.95	9.27	12.55	3.28	35.3	Started at inside. Silky; oblique.
68484B1F1	1.26	5.36	2.95	9.27	11.86	2.59	27.9	Started at outside. Fine granular.
64877B2	1.24	5.31	2.95	9.27	12.10	2.83	30.5	Started at inside. Lamellar.
68486B1	1.27	5.36	2.95	9.27	12.03	2.76	29.8	Started at inside. Fine granular.
68481B1F1	1.25	5.35	2.95	9.27	12.25	2.98	32.1	Do.
68482B2	1.25	5.38	2.95	9.27	12.22	2.95	31.8	Started at inside. Lamellar, 40 per cent; granular, 60 per cent.
71761B1	1.23	7.63	4.98	15.65	19.72	4.07	26.0	Started at inside. Fine granular.
71761B3	1.29	7.65	4.98	15.65	20.10	4.45	28.4	Do.
71762B1	1.18	7.67	4.98	15.65	19.35	3.70	23.6	Started at center. Fine granular.
69325B1	1.26	7.61	4.98	15.65	18.15	2.50	15.9	Started at inside. Fine granular.
71762B3	1.26	7.67	4.98	15.65	18.62	2.97	18.9	Started at outside. Fine granular.
70387B2	1.26	7.65	4.98	15.65	18.00	2.35	15.0	Do.
71761B2	1.24	7.65	4.98	15.65	17.05	1.40	8.9	Started at inside. Fine granular.
70750B2	1.20	7.77	4.98	15.65	18.97	3.32	21.2	Started at outside. Fine granular.
66649B3	1.27	7.63	4.98	15.65	18.90	3.25	20.7	Started at inside. Fine granular.
70388B1	1.23	7.62	4.98	15.65	19.55	3.90	24.9	Fractured in 2 places; 1 started at outside and 1 at inside. Both fine granular.

SHOT AND SHELL.

TENSILE TESTS OF TWO SPECIMENS FROM OPPOSITE SIDES OF STEEL SHELL FIRED IN ROUND 91, 6-INCH CROZIER R. F. WIRE-WOUND GUN NO. 1.

SAMPLES EXTENDED FROM BAND FORWARD TOWARD THE BOURRELET.

No. 8422.

Diameter, ″.564 .
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0002	0.	
10,000	.0005	.....	
20,000	.0014	.....	
30,000	.0024	.....	
35,000	.0030	.....	
40,000	.0035	−.0002	
45,000	.0040	.....	
50,000	.0044	.....	
55,000	.0050	.....	
60,000	.0055	.....	
65,000	.0060	.....	
70,000	.0065	.....	
75,000	.0070	.....	
80,000	.0075	.....	
85,000	.0081	.....	
90,000	.0087	.....	
95,000	.0096	.....	
99,000	.0102	.....	Elastic limit.
100,000	.0108	.....	
101,000	.0112	.....	
102,000	.0117	.....	
103,000	.0124	.....	
104,000	.0135	.....	
105,000	.0154	.....	
146,800	.....	.....	Tensile strength.
0	.29	.....	−9.7 per cent elongation in 3″.

Elongation of inch sections, ″.21*, ″.05, ″.03.
Diameter at fracture, ″.45; area, .1590 square inch.
Contraction of area, 36.4 per cent.
Fractured ″.60 from the neck.
Appearance of fracture, silky, interspersed with fine granulation.

No. 8423.

Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0003	0.	
10,000	.0008	.....	
20,000	.0017	.....	
30.000	.0027	.....	
40,000	.0037	0.	
50,000	.0047	.....	
60,000	.0057	.....	
70,000	.0067	.....	
80,000	.0077	.....	
90,000	.0090	.....	
95,000	.0100	.....	
100,000	.0115	.....	
101,000	.0117	.....	Elastic limit.
102,000	.0124	.....	
103,000	.0132	.....	
104,000	.0134	.....	
105,000	.0141	.....	
106,000	.0147	.....	
107,000	.0171	.....	
108,000	.0175	.....	
109,000	.0187	.....	
110,000	.0198	.....	
143,600	.....	.....	Tensile strength.
0	.28	.....	=9.3 per cent elongation in 3″.

Elongation of inch sections, ″.21*, ″.04, ″.03.
Diameter at fracture, ″.43; area, .1452 square inch.
Contraction of area, 41.9 per cent.
Fractured ″.40 from the neck.
Appearance of fracture, silky, interspersed with fine granulation.

STEEL FOR COMPARISON OF TESTING MACHINES.

TENSILE TESTS OF SIX STEEL BARS FOR COMPARISON OF TESTING MACHINE AT WATERVLIET ARSENAL.

No. 8362.

Marks, GL–1.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 3″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0002	0.	
10,000	.0005	.....	
20,000	.0013	.....	
30,000	.0025	0.	
35,000	.0029	.....	
40,000	.0034	.....	
45,000	.0039	.....	
48,000	.0044	.....	Elastic limit.
49,000	.0072	.....	
	.0115	.....	
50,000	.0138	.....	
51,000	.0147	.....	
52,000	.0182	.....	
107,000	.....	.....	Tensile strength.
0	.50	.....	=16.3 per cent elongation in 3″.

Elongation of inch sections, ″.12, ″.20*, ″.18*.
Diameter at fracture, ″.44; area, .1521 square inch.
Contraction of area, 24 per cent.
Fractured 1″.18 from the neck.
Appearance of fracture, fine granular; silky spot at circumference.

No. 8363.

Marks, GL–3.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 3″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0002	0.	
10,000	.0005	.....	
30,000	.0025	0.	
40,000	.0036	.....	
43,000	.0038	.....	
44,000	.0042	.....	Elastic limit.
45,000	.0090	.....	
46,000	.0114	.....	
47,000	.0135	.....	
48,000	.0143	.....	
49,000	.0160	.....	
50,000	.0193	.....	
101,500	.....	.....	Tensile strength.
0	.53	.....	=17.7 per cent elongation in 3″.

Elongation of inch sections, ″.12, ″.18*, ″.23*.
Diameter at fracture, ″.42; area, .1385 square inch.
Contraction of area, 30.7 per cent.
Fractured 1″.23 from the neck.
Appearance of fracture, granular; silky spot at circumference.

No. 8364.

Marks, GL–5.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 3″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0002	0.	
10,000	.0004	.....	
30,000	.0023	0.	
40,000	.0031	.....	
44,000	.0035	.....	
45,000	.0037	.....	
46,000	.0039	.....	Elastic limit.
47,000	.0053	.....	
48,000	.0117	.....	
49,000	.0124	.....	
50,000	.0140	.....	
104,500	.....	.....	Tensile strength.
0	.46	.....	=15.3 per cent elongation in 3″.

Elongation of inch sections, ″.19*, ″.16*, ″.11.
Diameter at fracture, ″.44; area, .1521 square inch.
Contraction of area, 24 per cent.
Fractured 1″.19 from the neck.
Appearance of fracture, fine granular; silky spot at circumference.

No. 8365.

Marks, GS–2.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 3″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0002	0.	
10,000	.0006	.....	
20,000	.0014	.....	
30,000	.0025	0.	
35,000	.0029	.....	
40,000	.0033	.....	
45,000	.0040	.....	
50,000	.0045	.....	
51,000	.0046	.....	
52,000	.0048	.....	Elastic limit.
53,000	.0175	.....	
54,000	.0190	.....	
55,000	.0228	.....	
95,500	.....	.....	Tensile strength.
0	.68	.....	=22.7 per cent elongation in 3″.

Elongation of inch sections, ″.17, ″.37*, ″.14.
Diameter at fracture, ″.34; area, .0908 square inch.
Contraction of area, 54.6 per cent.
Fractured 1″.5 from the neck.
Appearance of fracture, fine silky.

No. 8366.

Marks, GS–4.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 3″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0003	0.	
10,000	.0008	.....	
30,000	.0028	0.	
40,000	.0040	.....	
45,000	.0043	.....	
50,000	.0050	.....	
54,000	.0054	.....	
55,000	.0056	.....	
56,000	.0057	.....	Elastic limit.
	.0080	.....	
57,000	.0228	.....	
58,000	.0228	.....	
59,000	.0229	.....	
60,000	.0250	.....	
61,000	.0281	.....	
96,500	.....	.....	Tensile strength.
0	.68	.....	=22.7 per cent elongation in 3″.

Elongation of inch sections, ″.13, ″.29*, ″.26*.
Diameter at fracture, ″.34; area, .0908 square inch.
Contraction of area, 54.6 per cent.
Fractured 1″.28 from the neck.
Appearance of fracture, fine silky.

No. 8367.

Marks, GS–6.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 3″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0003	0.	
10,000	.0008	.....	
30,000	.0028	0.	
40,000	.0038	.....	
45,000	.0043	.....	
50,000	.0048	.....	
55,000	.0053	.....	
56,000	.0055	.....	Elastic limit.
57,000	.0065	.....	
	.0170	.....	
58,000	.0197	.....	
59,000	.0228	.....	
60,000	.0252	.....	
61,000	.0275	.....	
98,000	.....	.....	Tensile strength.
0	.61	.....	=20.3 per cent elongation in 3″.

Elongation of inch sections, ″.35*, ″.15, ″.11.
Diameter at fracture, ″.35; area, .0962 square inch.
Contraction of area, 51.9 per cent.
Fractured ″.9 from the neck.
Appearance of fracture, fine silky.

TENSILE TESTS OF FIVE MACHINERY STEEL BARS FOR COMPARISON OF TESTING MACHINE AT FRANKFORD ARSENAL.

No. 8416.

Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0003	0.	
10,000	.0007	.....	
20,000	.0014	.....	
30,000	.0021	0.	
35,000	.0024	.....	
40,000	.0028	.....	
45,000	.0031	.....	
50,000	.0035	.....	
55,000	.0039	.....	
56,000	.0040	.....	
57,000	.0042	.....	Elastic limit.
	.0143	.....	
58,000	.0146	.....	
59,000	.0148	.....	
60,000	.0150	.....	
61,000	.0165	.....	
62,000	.0306	.....	
64,000	.0460	.....	
69,000	.....	.....	Tensile strength.
0	.46	.....	=23 per cent elongation in 2″.

Elongation of inch sections, ″.28*, ″.18.
Diameter at fracture, ″.30; area, .0707 square inch.
Contraction of area, 64.6 per cent.
Fractured at middle of stem.
Appearance of fracture, silky.

No. 8417.

Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0003	0.	
10,000	.0006	.....	
20,000	.0013	.....	
30,000	.0018	0.	
35,000	.0022	.....	
40,000	.0025	.....	
45,000	.0029	.....	
50,000	.0033	.....	
55,000	.0037	.....	
57,000	.0040	.....	
58,000	.0042	.....	Elastic limit.
59,000	.0049	.....	
60,000	.0070	.....	
61,000	.0142	.....	
62,000	.0246	.....	
69,000	.....	.....	Tensile strength.
0	.46	.....	=23 per cent elongation in 2″.

Elongation of inch sections, ″.32*, ″.14.
Diameter at fracture, ″.30; area, .0707 square inch.
Contraction of area, 64.6 per cent.
Fractured at middle of stem.
Appearance of fracture, silky.

No. 8418.

Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0003	0.	
10,000	.0007	.....	
20,000	.0015	.....	
30,000	.0020	0.	
35,000	.0025	.....	
40,000	.0028	.....	
45,000	.0031	.....	
50,000	.0035	.....	
55,000	.0039	.....	
57,000	.0040	.....	
58,000	.0041	.....	
59,000	.0043	.....	Elastic limit.
60,000	.0113	.....	
61,000	.0442	.....	
69,000	.....	.....	Tensile strength.
0	.47	.....	= 23.5 per cent elongation in 2″.

Elongation of inch sections, ″.18, ″.29*.
Diameter at fracture, ″.30; area, .0707 square inch.
Contraction of area, 64.6 per cent.
Fractured 1″.17 from the neck.
Appearance of fracture, silky.

No. 8419.

Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	
5,000	.0003	0.	
10,000	.0005	.....	
20,000	.0011	.....	
30,000	.0019	0.	
35,000	.0021	.....	
40,000	.0024	.....	
45,000	.0026	.....	
50,000	.0030	.....	
55,000	.0034	.....	
56,000	.0035	.....	Elastic limit.
57,000	.0038	.....	
58,000	.0043	.....	
59,000	.0048	.....	
60,000	.0066	.....	
61,000	.0118	.....	
62,000	.0285	.....	
63,000	.0330	.....	
64,000	.0420	.....	
69,500	.....	.....	Tensile strength.
0	.46	.....	= 23 per cent elongation in 2″.

Elongation of inch sections, ″.30*, ″.16.
Diameter at fracture, ″.30; area, .0707 square inch.
Contraction of area, 64.6 per cent.
Fractured at middle of stem.
Appearance of fracture, silky.

No. 8420.

Diameter, ″.505.
Sectional area, .20 square inch
Gauged length, 2″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0003	0.	
10,000	.0006	.....	
20,000	.0012	.....	
30,000	.0018	0.	
35,000	.0021	.....	
40,000	.0025	.....	
45,000	.0029	.....	
55,000	.0034	.....	
57,000	.0036	.....	
58,000	.0038	.....	Elastic limit.
59,000	.0042	.....	
60,000	.0052	.....	
61,000	.0084	.....	
62,000	.0200	.....	
63,000	.0280	.....	
64,000	.0360	.....	
69,500	.....	.....	Tensile strength.
0	.43	.....	= 21.5 per cent elongation in 2″.

Elongation of inch sections, ″.26*, ″.17.
Diameter at fracture, ″.30; area, .0707 square inch.
Contraction of area, 64.6 per cent.
Fractured at middle of stem.
Appearance of fracture, silky.

TENSILE TESTS OF THREE STEEL BARS FOR COMPARISON OF TESTING MACHINE AT BETHLEHEM STEEL WORKS.

No. 8425.

Marks, Z–599.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0002	.....	
10,000	.0005	0.	
20,000	.0015	.....	
30,000	.0019	0.	
35,000	.0023	.....	
40,000	.0027	.....	
45,000	.0030	.....	
50,000	.0034	.....	
55,000	.0037	.....	
60,000	.0041	.....	
65,000	.0045	.....	
70,000	.0047	.....	
75,000	.0050	.....	
78,000	.0054	.....	Elastic limit.
79,000	.0065	.....	
86,000	.0507	.....	
109,000	.....	.....	Tensile strength.
0	.55	.....	= 27.5 per cent elongation in 2″.

Elongation of inch sections, ″.17, ″.38*.
Diameter at fracture, ″.32; area, .0804 square inch.
Contraction of area, 59.8 per cent.
Fractured 1″ from the neck.
Appearance of fracture, fine silky, cup-shaped.

No. 8426.

Marks, Z–601.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0003	0.	
10,000	.0005	.....	
20,000	.0013	.....	
30,000	.0020	—.0001	
35,000	.0023	.....	
40,000	.0025	.....	
45,000	.0029	.....	
50,000	.0032	.....	
55,000	.0035	.....	
60,000	.0039	.....	
65,000	.0043	.....	
70,000	.0046	.....	
75,000	.0049	.....	
76,000	.0051	.....	
77,000	.0052	.....	Elastic limit.
	.0445	.....	
108,500	.....	.....	Tensile strength.
0	.55	.....	=27.5 per cent elongation in 2″.

Elongation of inch sections, ″.28*, ″.27*.
Diameter at fracture, ″.32; area, .0804.
Contraction of area, 59.8 per cent.
Fractured at middle of stem.
Appearance of fracture, fine silky, cup-shaped.

No. 8427.

Marks, Z–603.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0002	0.	
10,000	.0005	.....	
20,000	.0012	.....	
30,000	.0019	0.	
35,000	.0022	.....	
40,000	.0026	.....	
45,000	.0028	.....	
50,000	.0033	.....	
55,000	.0037	.....	
60,000	.0039	.....	
65,000	.0042	.....	
70,000	.0046	.....	
75,000	.0049	.....	
78,000	.0052	.....	Elastic limit.
	.0463	.....	
108,500	.....	.....	Tensile strength.
0	.55	.....	=27.5 per cent elongation in 2″.

Elongation of inch sections, ″.19, ″.36*.
Diameter at fracture, ″.31; area, .0755 square inch.
Contraction of area, 62.2 per cent.
Fractured 1″.09 from the neck.
Appearance of fracture, fine silky, cup-shaped.

TABULATION OF TENSION SPECIMENS FOR COMPARISON OF TESTING MACHINES.

STEMS OF SPECIMENS ".505 DIAMETER; 2" AND 3" LONG.

No. of test.	Marks.	For comparing testing machine at—	Elastic limit per square inch.	Tensile strength per square inch.	Elongation.	Contraction of area.	Elongation of inch sections			Appearance of fracture.
			Pounds.	*Pounds.*	*Per cent.*	*Per cent.*	"	"	"	
8362	GL-1	Watervliet Arsenal	46,000	107,000	16.3	24.0	.12,	.20*,	.18*	Fine granular. Silky spot.
8363	GL-3	.....do	44,000	101,500	17.7	30.7	.12,	.18*,	.23*	Granular. Silky spot.
8364	GL-5	.....do	46,000	104,500	15.3	24.0	.19*,	.16*,	.11	Fine granular. Silky spot.
8365	GS-2	.....do	52,000	95,500	22.7	54.6	.17,	.37*,	.14	Fine silky.
8366	GS-4	.....do	56,000	98,500	22.7	54.6	.13,	.29*,	.20*	Do.
8367	GS-6	.....do	56,000	98,000	20.3	51.9	.35*,	.15,	.11	Do.
8416	.....	Frankford Arsenal	57,000	69,000	23.0	64.6	.28*,	.18		Silky.
8417	.....	.....do	58,000	69,000	23.0	64.6	.32*,	.14		Do.
8418	.....	.....do	59,000	69,000	23.5	64.6	.18,	.29*		Do.
8419	.....	.....do	56,000	69,500	23.0	64.6	.30*,	.16		Do.
8420	.....	.....do	58,000	69,500	21.5	64.6	.26*,	.17		Do.
8425	Z-599	Bethlehem Steel Works	78,000	109,000	27.5	59.8	.17,	.39*		Fine silky; cup-shaped.
8426	Z-601	.....do	77,000	108,500	27.5	59.8	.28*,	.27*		Do.
8427	Z-603	.....do	78,000	108,500	27.5	62.2	.19,	.36*		Do.

MISCELLANEOUS STEELS.

TENSILE AND BENDING TESTS AND CHEMICAL ANALYSES.

AMORPHOUS STEEL.

From Midvale Steel Company.
Metal for vent erosion tests.
Diameter of specimens, ″.505.
Sectional area, .20 square inch.

TENSILE TESTS.

Marks.	Elastic limit per square inch.	Tensile strength per square inch.	Elongation in 2 inches.	Contraction of area.	Elongation of inch sections.	Appearance of fracture.
	Pounds.	*Pounds.*	*Per cent.*	*Per cent.*	″ ″	
G	106,000	123,000	16.0	40.3	.22*, .10	Fine silky.
H	107,500	124,000	16.0	40.3	.18*, .14	Do
L	102,500	120,500	16.0	43.3	.08, .24*	Do.

RESISTA STEEL.

CHEMICAL COMPOSITION.

Carbon	.272
Silicon	.152
Iron	5.08
Nickel	66.47
Copper	28.02

TENSILE TESTS.

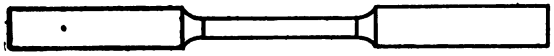
Specimen drawn down from $2\frac{5}{8}$″ diameter to ″.86 diameter.

Sectional area	square inch..	.581
Scale starts off at 42,000 pounds =	pounds per square inch..	72,290
Tensile strength, 60,200 pounds =	do...	103,610
Diameter at fracture, ″.56 = area	square inch..	.246
Contraction of area	per cent..	57.7
Appearance of fracture		silky.

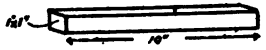
Second specimen from same bar.

Sectional area	square inch..	.503
Elastic limit not well defined; change in rate of elongation at 16,000 to 18,000 pounds total load.		
Tensile strength, 44,100 pounds =	pounds per square inch	87,670
Elongation in 10″, 1″.87 =	per cent..	18.7
Diameter at fracture, ″.71 = area	square inch..	.396
Contraction of area	per cent..	21.3
Appearance of fracture		gray, amorphous
Elongation of inch sections	″.16, ″.25*, ″.20, ″.19, ″.20, ″.18, ″.18, ″.17, ″.16, ″18	

ANCHOR BOLT FOR GUN CARRIAGE.



Tension specimen.



Bending specimen.

Description.	Diameter.	Sectional area.	Elastic limit per square inch.	Tensile strength per square inch.	Elongation.	Contraction of area.	Elongation of inch sections.	Appearance of fracture.	Bending test.
	Inch.	*Sq.inch.*	*Pounds.*	*Pounds.*	*Per cent.*	*Per cent.*	" " "		
Anchor bolt received from U. S. Engineer Corps, Boston Mass.	.798	.50	44,800	63,600	30.2	63.8	.19, .26, .31, .66*, .29, .26 .25, .20	Fine silky; cup-shaped.	Bent cold 180° and closed down without fracture

Chemical Analyses of Miscellaneous Steels.

FROM SPRINGFIELD ARMORY.

Description.	Combined carbon.	Manganese.	Silicon.	Sulphur	Phosphorus.	Nickel.
Bayonet steel	.940	.337	.198	.026	.025	.....
Receiver steel	.320	1.250	.070	.079	.048	
Receiver steel, "Ill. 9"	.392	.917	.027	.062	.108	
Receiver steel, "Ill. 10"	.336	.826	.009	.120	.120	.....
Receiver steel "M. 10"	.253	1.070	.159	.049	.090	.....
Receiver steel, "M. 11"	.291	.947	.106	.036	.081	.....
Barrel steel, J17, crucible, from Water shops.	.520	1.200	.210	.058	.052	.....
Barrel steel, C13, 37719 pounds, Carpenter steel	.460	1.139	.018	.051	.052	.....
Rear sight fixed base steel, from Water shops	.150	.652	.003	.120	.115	.....
Upper band steel, from Water shops	.152	.790	.005	.106	.058	.....
Steel for sleeves, from Water shops	.148	.760	.009	.069	.093	.....
Bolt steel, from Water shops	.750	.380	.266	.028	.023	.....
Front sight fixed stud, from Water shops	.145	.820	.063	.078	.073	.....
Steel for bayonet blades, from Water shops	.960	.450	.076	.029	.022	.....
Steel for Hospital Corps knives, from Water shops	.640	.840	.113	.028	.022	.....
Steel for butt plates, from Water shops	.150	.475	.005	.082	.089	.....
Steel for cocking pieces, from Water shops	.145	.550	.003	.072	.077	.....
Steel for cut-off sleeve, from Water shops	.165	.750	.003	.077	.083	.....
Sear steel and leaf steel, from Water shops	.158	.540	.005	.113	.075	.....
Floor plate sleeve	.135	.477	.008	.104	.090	.....
Steel for officers' saber blades, second sample from Water shops	1.000	.265	.124	.031	.016	.....
Hospital Corps knives, 1½×½, from Carpenter Steel Co., C. H. C. K	1.000	.280	.123	.024	.020	.....
Rear sight base steel, second sample from Water shops	.130	.560	.003	.120	.098	.....
Ejector steel, second sample	.131	.560	.003	.117	.110	.....
Bolt steel, "S. 33, .89×.7, 26753 lbs"	.570	1.210	.197	.068	.055	.....
"Bayonet steel from F. L. Helmuth, 54615 lbs., Jan. 24, 1907"	1.020	.297	.170	.024	.023	.....
"Rear sight base from Amr. Steel & Wire Co., 29384 lbs., recd. Jan. 3, 1907"	.150	.650	.005	.119	.092	.....
"Base spring steel from Crucible Steel Co., 3,002 lbs., recd. Jan 26, '07"	1.000	.329	.133	.024	.025	.....
"Guard steel, Midvale Steel Co., 49355 lbs., June 19, 1906"	.332	.620	.150	.050	.050	.....
"Guard steel, Colonial Steel Co., 47577 lbs., Oct. 9, 1906"	.505	.498	.003	.041	.025	.....
Bayonet catch, "second sample"	.135	.561	.003	.103	.008	.....
Rifle barrel steel, Bethlehem Steel Co., No. 828	.521	.940	.165	.055	.035	.....

FROM ROCK ISLAND ARSENAL.

Armor plate	.416	.490	.265	.015	.015	6.680

STEEL WIRE.

TENSILE TESTS OF STEEL WIRE FOR CONSTRUCTION OF 6-INCH CROZIER WIRE WOUND GUN, EXPERIMENTAL.

Received from Watervliet Arsenal.
Samples were straightened approximately before testing.

No. 8283.

First sample, coil 1.
Cross section dimensions, ″.100×″.099.
Sectional area, .0099 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
204	20,610	0.	0.	Initial load.
408	41,210	.0049	.....	
612	61,820	.0097	.....	
816	82,420	.0149	.....	
1,020	103,030	.0203	.0018	E (204-1,020)=26,731,000 pounds per square inch.
1,224	123,640	.0262	.....	
1,428	144,240	.0330	.....	
1,530	154,550	.0366	.....	
1,632	164,850	.0404	.....	
1,734	175,150	.0451	.....	
1,836	185,450	.0509	.0119	
1,938	195,760	.0579	.....	
2,040	206,060	.0701	.0263	E (1,020-2,040)=24,434,000 pounds per square inch.
2,264	228,690	.....	.....	Tensile strength.
0	0	.09	.....	=1.5 per cent elongation in 6″.

Area at fracture, ″.073×″.073=.0053 square inch.
Contraction of area, 46.5 per cent.
Fractured 1¼″ outside the gauged length.
Appearance of fracture, fine silky.

No. 8284.

Second sample, coil 1. (From opposite end to first sample.)
Cross-section dimensions, ″.100 × ″.099.
Sectional area, .0099 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
204	20,610	0.	0.	Initial load.
408	41,210	.0048	0.	
612	61,820	.0096	.0004	
816	82,420	.0146	.0007	
1,020	103,030	.0201	.0015	E (204–1,020)=26,587,000 pounds per square inch.
1,224	123,640	.0258	.0023	
1,428	144,240	.0326	.0042	
1,530	154,550	.0362	.0055	
1,632	164,850	.0401	.0069	
1,734	175,150	.0431	.0090	
1,836	185,450	.0505	.0118	
1,938	195,760	.0576	.0168	
2,040	206,060	.0678	.0259	E (1,020–2,040)=26,531,000 pounds per square inch.
2,254	227,680	.....	.....	Tensile strength.
0	0	.14	.....	=2.3 per cent elongation in 6″.

Area at fracture, ″.072 × ″.072 = .0052 square inch.
Contraction of area, 47.5 per cent.
Fractured ½″ outside the gauged length.
Appearance of fracture, fine silky.

No. 8285.

First sample, coil 2.
Cross-section dimensions, ″.100 × ″.099.
Sectional area, .0099 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
204	20,610	0.	0.	Initial load.
408	41,210	.0051	0.	
612	61,820	.0099	.0002	
816	82,420	.0154	.0008	
1,020	103,030	.0207	.0018	E (204–1,020)=26,165,000 pounds per square inch.
1,224	123,640	.0266	.0029	Wire slipped in jaws; micrometer removed.
2,222	224,440	.....	.....	Tensile strength.
0	0	.08	.....	= 1.3 per cent elongation in 6″.

Area at fracture, ″.075 × ″.075 = .0056 square inch.
Contraction of area, 43.4 per cent.
Fractured at face of jaws.
Appearance of fracture, fine silky.

No. 8286.

Second sample, coil 2. (From opposite end to first sample.)
Cross-section dimensions, ″.100 × ″.099.
Sectional area, .0099 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
204	20,610	0.	0.	Initial load.
408	41,210	.0047	0.	
612	61,820	.0094	.0001	
816	82,420	.0150	.0006	
1,020	103,030	.0202	.0011	E (204–1,020)=25,891,000 pounds per square inch.
1,224	123,640	.0263	.0027	
1,428	144,240	.0337	.0051	
1,530	154,550	.0379	.0069	
1,632	164,850	.0425	.0091	
1,734	175,150	.0474	.0126	
1,836	185,450	.0540	.0170	
1,938	195,760	.0641	.0243	
2,040	206,060	.0835	.0409	E (1,020–2,040)=26,306,000 pounds per square inch.
2,172	219,390	.....	.....	Tensile strength.
0	0	.18	.....	=3 per cent elongation in 6″.

Area at fracture, ″.068 × ″.068 = .0046 square inch.
Contraction of area, 53.5 per cent.
Fractured 1¾″ inside the gauged length.
Appearance of fracture, fine silky.

TABULATION OF TENSION TESTS OF STEEL WIRE.

Cross-section dimensions, ″.100 × ″.099.
Sectional area, .0099 square inch.
Gauged length, 6″.

Description.	Tensile strength per square inch.	Elongation in inches.	Contraction of area.	Apparent modulus of elasticity per square inch between—		Appearance of fracture.
				204 and 1,020 pounds.	1,020 and 2,040 pounds.	
	Pounds.	*Per cent.*	*Per cent.*	*Pounds.*	*Pounds.*	
First sample, coil 1.	228,690	1.5	46.5	26,731,000	24,434,000	Fine silky.
Second sample, coil 1.	227,680	2.3	47.5	26,587,000	26,531,000	Do.
First sample, coil 2.	224,440	1.3	43.4	26,165,000	.....	Do.
Second sample, coil 2.	219,390	3.0	53.5	25,891,000	26,306,000	Do.

CURB BITS AND STIRRUPS.

CURB BITS.

Tests of curb bits made from steel, monel metal and eglentine metal.

STEEL BITS.

FIRST SAMPLE.

Marks.	Test of—	Description.	Tensile strength.	Position of fracture.
			Pounds.	
2 U. S. 1905 R. I. A.	Mouthpiece	Pulling load applied at junction of mouthpiece and branches. Diameter at junction, ".65"; at middle of mouthpiece, ".48".	8,100	At junction of branch; 1 end of branch ruptured.
	Eye and ring of branch		2,620	Fractured the eye.

SECOND SAMPLE.

2 U. S. 1905 R. I. A.	Mouthpiece	Pulling load applied at junction of mouthpiece and branches. Diameter at junction, ".65"; at middle of mouthpiece, ".47".	8,900	Mouthpiece, ¾" from end.
	Eye and ring of branch		2,950	Fractured the ring.
	Eye and ring of other branch.		2,100	Fractured the eye.

MONEL METAL BITS.

FIRST SAMPLE.

1 U. S. 1906 R. I. A. M.	Mouthpiece	Pulling load applied at junction of mouthpiece and branches. Diameter at junction, ".64"; at middle of mouthpiece, ".51".	3,510	¾" from end of mouthpiece; smooth, amorphous surface.
	Eye and ring of branch		2,410	Fractured the eye.
	Eye and ring of other branch.		2,630	Fractured the ring.

SECOND SAMPLE.

1 U. S. 1906 R. I. A. M.	.....	The mouthpiece of this bit was fractured in 2 places when received at the testing laboratory.		
	Eye and ring of branch		2,430	Fractured the eye.
	Eye and ring of other branch.		2,920	Do.

EGLENTINE METAL BITS.

FIRST SAMPLE.

Eglentine	Mouthpiece	Pulling load applied at junction of mouthpiece and branches. Diameter at junction, ".65; at middle of mouthpiece, ".54.	4,160	1½" from end of mouthpiece. Gray, amorphous; spongy metal on one side.
	Eye and ring of branch		410	Fractured the branch near ring.
	Eye and ring of other branch.		440	Fractured the ring.

SECOND SAMPLE.

Eglentine	Mouthpiece	Pulling load applied at junction of mouthpiece and branches. Diameter at junction, ".65; at middle of mouthpiece, ".52.	3,020	1½" from end of mouthpiece. Gray, amorphous; spongy metal in part.
	Eye and ring of branch		440	Fractured the ring.
	Eye and ring of other branch.		400	Fractured the branch near ring.

EGLENTINE METAL.

Tensile tests and chemical analysis of metal taken from the treads of two stirrups.

TENSILE TESTS.

Diameter of specimens, ″.200.
Sectional area, .0314 square inch.

No. of stirrup.	Elastic limit per square inch.	Tensile strength per square inch.	Elongation in 1 inch.	Contraction of area.	Appearance of fracture.
	Pounds.	*Pounds.*	*Per cent.*	*Per cent.*	
1	38,850	44,270	4.0	(a)	Light gray.
1	36,310	42,040	4.0	(a)	Do.
2	37,580	50,640	9.0	19.1	Do.
2	36,940	55,730	12.0	19.1	Do.

a Inappreciable.

CHEMICAL ANALYSIS.

Copper	45.89
Zinc	21.69
Iron	.92
Nickel	31.50

MONEL METAL.

TENSILE TESTS OF MONEL METAL.

No. 8403.

Cast specimen.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 10″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0019	0.	
10,000	.0039	0.	
15,000	.0060	−.0001	
20,000	.0083	0.	
24,000	.....	.....	Approximate elastic limit.
25,000	.0210	.0120	
26,000	.0350	.....	
27,000	.0510	.....	
28,000	.0700	.....	
29,000	.1110	.....	
30,000	.160	.....	
31,000	.24	.....	
32,000	.31	.....	
33,000	.36	.....	
34,000	.40	.....	
35,000	.46	.....	
36,000	.52	.....	
37,000	.58	.....	
38,000	.64	.....	
39,000	.70	.....	
39,800	.....	.....	Tensile strength.
0	.82	.....	= 8.2 per cent elongation in 10″.

Elongation of inch sections, ″.06, ″.08, ″.07, ″.17*, ″.10, ″.07, ″.06, ″.07, ″.08, ″.06.

Diameter at fracture, 1″.03; area, .833 square inch.

Contraction of area, 16.7 per cent.

Fractured 3″.75 from the neck.

Appearance of fracture, light gray; columnar structure converging to the center; amorphous center.

No. 8404.

Cast specimen.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 10″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0018	0.	
10,000	.0040	0.	
15,000	.0064	0.	
20,000	.0088	.0001	
21,000	.0092	.....	
22,000	.0101	.....	
23,000	.0117	.....	Elastic limit.
24,000	.0163	.....	
25,000	.0240	.....	
26,000	.0350	.....	
27,000	.0550	.....	
28,000	.0855	.....	
29,000	.1200	.....	
30,000	.1650	.....	
31,000	.25	.....	
32,000	.33	.....	
33,000	.38	.....	
34,000	.43	.....	
35,000	.50	.....	
36,000	.54	.....	
37,000	.61	.....	
38,000	.68	.....	
38,600	.....	.....	Tensile strength.
0	.82	.....	= 8.2 per cent elongation in 10″.

Elongation of inch sections, ″.06, ″.07, ″.07, ″.21*, ″.09, ″.05, ″.06, ″.08, ″.06 ″.07.

Diameter at fracture, 1″.04; area, .849 square inch.

Contraction of area, 15.1 per cent.

Fractured 4″ from the neck.

Appearance of fracture, light gray; columnar structure converging to the center; amorphous, spongy center.

No. 8405.

Forged specimen.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 10″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inches.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0018	0.	
10,000	.0038	0.	
20,000	.0079	0.	
25,000	.0097		
30,000	.0117	0.	
35,000	.0135		
40,000	.0158	.0002	
41,000	.0162		
42,000	.0169		
43,000	.0178		
44,000	.0190		Elastic limit.
45,000	.0250	.0025	
46,000	.0351		
47,000	.0490		
48,000	.0650		
49,000	.0810		
50,000	.1090		
52,000	.18		
54,000	.24		
56,000	.30		
58,000	.38		
60,000	.45		
62,000	.53		
64,000	.61		
66,000	.70		
68,000	.80		
70,000	.92		
72,000	1.05		
74,000	1.18		
76,000	1.35		
78,000	1.53		
80,000	1.79		
83,600			Tensile strength.
0	3.38		= 33.8 per cent elongation in 10″.

Elongation of inch sections, ″.21, ″.26, ″.29, ″.33, ″.35, ″.44, ″.75*, ″.30, ″.25, ″.20.
Diameter at fracture, ″.68; area, .363 square inch.
Contraction of area, 63.7 per cent.
Fractured 5″.5 from the neck.
Appearance of fracture, light gray, silky; surface of stem seamy.

No. 8406.

Forged specimen.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 10″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inches.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0014	0.	
10,000	.0037	0.	
20,000	.0073	−.0001	
30,000	.0113	−.0001	
35,000	.0135		
37,000			Approximate elastic limit.
38,000	.0308		
39,000	.0420		
40,000	.0620		
41,000	.0886		
42,000	.1080		
43,000	.1330		
44,000	.1650		
45,000	.19		
46,000	.22		
47,000	.25		
48,000	.29		
49,000	.33		
50,000	.36		
52,000	.43		
54,000	.50		
56,000	.58		
58,000	.65		
60,000	.74		
62,000	.82		
64,000	.91		
66,000	1.02		
68,000	1.13		
70,000	1.26		
72,000	1.40		
74,000	1.57		
76,000	1.78		
78,000	1.99		
80,000	2.35		
82,000	3.15		Tensile strength.
0	3.60		= 36 per cent elongation in 10″.

Elongation of inch sections, ″.29, ″.37, ″.77*, ″.36, ″.34, ″.34, ″.32, ″.31, ″.27, ″.23.
Diameter at fracture, ″.70; area, .385 square inch.
Contraction of area, 61.5 per cent.
Fractured 3″.5 from the neck.
Appearance of fracture, light gray, silky; surface of stem seamy.

No. 8431.

Forged bar; finished at a bright red color.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 10″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0019	0.	
10,000	.0040	.....	
20,000	.0062	.....	
29,000	.....	.....	Approximate elastic limit.
30,000	.0131	.0009	
31,000	.0137	.....	
32,000	.0140	.....	
33,000	.0147	.....	
34,000	.0153	.....	
35,000	.0161	.....	
36,000	.0172	.....	
37,000	.0185	.....	
38,000	.0201	.....	
39,000	.0227	.....	
40,000	.0285	.0124	
42,000	.0392	.....	
44,000	.0620	.....	
46,000	.12	.....	
48,000	.18	.....	
50,000	.28	.....	
52,000	.36	.....	
54,000	.44	.....	
56,000	.53	.....	
58,000	.....	.....	Tensile strength.
0	.69	.....	= 6.9 per cent elongation in 10″.

Elongation of inch sections, ″.05, ″.07, ″.06, ″.15*, ″.07, ″.06, ″.06, ″.06, ″.06, ″.05.
Diameter at fracture, 1″.01; area, .801 square inch.
Contraction of area, 19.9 per cent.
Fractured 3″.85 from the neck.
Appearance of fracture, gray; amorphous.

No. 8432.

Forged bar; finished at a dark red color.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 10″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0018	0.	
10,000	.0039	.....	
20,000	.0083	.....	
25,000	.0102	.....	
30,000	.0128	0.	
[illegible],000	.0130	.....	
32,000	.0137	.....	
33,000	.0141	.....	
34,000	.0148	.....	
35,000	.0152	.....	
36,000	.0159	.....	
37,000	.0165	.....	
38,000	.0173	.....	
39,000	.0183	.....	
40,000	.0194	.0020	
41,000	.0202	.....	
42,000	.0218	.....	
43,000	.0240	.....	
44,000	.0273	.....	
46,000	.0427	.....	
48,000	.0780	.....	
50,000	.1450	.....	
52,000	.25	.....	
54,000	.....	.....	Tensile strength.
0	.41	.....	= 4.1 per cent elongation in 10″.

Elongation of inch sections, ″.03, ″.04, ″.03, ″.14*, ″.03, ″.04, ″.02, ″.03, ″.03, ″.02.

Diameter at fracture, 1″.01; area, .801 square inch.

Contraction of area, 19.9 per cent.

Fractured 3″.74 from the neck.

Appearance of fracture, gray; columnar, converging at center of specimen.

No well-defined elastic limit.

No. 8433.

Forged bar; finished at a black heat.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 10″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0017	0.	
10,000	.0038	.....	
20,000	.0080	.....	
30,000	.0123	0.	
31,000	.0129	.....	
32,000	.0133	.....	
33,000	.0138	.....	
34,000	.0141	.....	
35,000	.0146	.....	
36,000	.0150	.....	
37,000	.0157	.....	
38,000	.0159	.....	
39,000	.0163	.....	
40,000	.0170	0.	
41,000	.0174	.....	
42,000	.0178	.....	
43,000	.0183	.....	
44,000	.0190	.....	
45,000	.0198	.....	
46,000	.0203	.....	
47,000	.0210	.....	
48,000	.0220	.....	
49,000	.0228	.....	
50,000	.0238	.0035	
51,000	.0251	.....	
52,000	.0260	.....	
53,000	.0284	.....	
54,000	.0324	.....	
55,000	.0355	.0115	
56,000	.05	.....	
58,000	.08	.....	
60,000	.....	.....	Tensile strength.
0	.20	.....	= 2 per cent elongation in 10″.

Elongation of inch sections, ″.10*, ″.02, ″.02, ″.03, ″.01, 0.″, ″.01, 0″., 0″., ″.01.

Diameter at fracture, 1″.02; area, .817 square inch.

Contraction of area, 18.3 per cent.

Fractured 1″ from the neck.

Appearance of fracture, gray; columnar, converging toward spongy center.

No well-defined elastic limit.

No. 8434.

Forged bar; annealed after forging.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 10″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inches.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0019	0.	
10,000	.0037	.....	
20,000	.0074	.....	
25,000	.0098	0.	
30,000	.0118	.0001	
31,000	.0123	.....	
32,000	.0129	.....	
33,000	.0141	.....	
34,000	.0230	.....	
35,000	.0370	.....	
36,000	.0540	.....	
37,000	.0750	.....	
38,000	.0950	.....	
39,000	.1150	.....	
40,000	.1410	.....	
41,000	.17	.....	
42,000	.21	.....	
43,000	.22	.....	
44,000	.26	.....	
46,000	.31	.....	
48,000	.36	.....	
50,000	.42	.....	
52,000	.49	.....	
54,000	.56	.....	
56,000	.64	.....	
58,000	.71	.....	
60,000	.79	.....	
62,000	.88	.....	
64,000	.97	.....	
66,000	1.06	.....	
68,000	1.18	.....	
70,000	1.30	.....	
72,000	1.42	.....	
74,000	1.58	.....	
76,000	1.76	.....	
78,000	1.96	.....	
80,000	2.28	.....	
82,000	2.82	.....	
83,000	.....	.....	Tensile strength.
0	3.86	.....	= 38.6 per cent elongation in 10″.

Elongation of inch sections, ″.27, ″.33, ″.35, ″.34, ″.35, ″.34, ″.37, ″.75*, ″.45, ″.31.
Diameter at fracture, ″.70; area, .385 square inch.
Contraction of area, 61.5 per cent.
Fractured 3″.50 from the neck.
Appearance of fracture, gray; silky; seamy.
No well-defined elastic limit.

TABULATION OF TENSION SPECIMENS OF MONEL METAL.

Diameter of specimens, 1″.129.
Sectional area, 1 square inch.
Gauged length, 10″.

No. of test.	Description and treatment.	Elastic limit per square inch.	Tensile strength per square inch.	Elongation in 10 inches.	Contraction of area.	Elongation of inch sections.	Appearance of fracture.
		Pounds.	*Pounds.*	*Per cent.*	*Per cent.*	″ ″ ″ ″ ″	
8403	Cast specimen	[a] 24,000	39,800	8.2	16.7	.06, .08, .07, .17*, .10, .07, .06, .07, .08, .06	Light gray; columnar structure converging to the center; amorphous center.
8404	.....do	23,000	38,600	8.2	15.1	.06, .07, .07, .21*, .09, .05, .06, .06, .06, .07	Do.
8405	Forged specimen	44,000	83,600	33.8	63.7	.21, .26, .29, .33, .35, .44, .75*, .30, .25, .20	Light gray; silky; surface of stem seamy.
8406	.....do	[a] 37,000	82,000	36.0	61.5	.29, .37, .77*, .36, .34, .34, .32, .31, .27, .23	Do.
8431	Forged bar; finished at a bright red color	[a] 29,000	58,000	6.9	19.9	.05, .07, .06, .15*, .07, .06, .06, .06, .06, .05	Gray; amorphous.
8432	Forged bar; finished at a dark red color	([b])	54,000	4.1	19.9	.03, .04, .03, .14*, .03, .04, .02, .03, .03, .02	Gray; columnar, converging at center of specimen.
8433	Forged bar; finished at a black heat	([b])	60,000	2.0	18.3	.10*, .02, .02, .03, .01, 0, .01, 0, 0, .01	Gray; columnar, converging toward spongy center.
8434	Forged bar; annealed after forging	([b])	83,000	38.6	61.5	.27, .33, .35, .34, .35, .34, .37, .75*, .45, .31	Gray; silky; seamy.

[a] Approximate.

[b] Not well defined.

CHEMICAL ANALYSIS OF MONEL METAL.

(Specimen 8431.)

Nickel	68.52
Copper	28.26
Iron	3.22

FRICTIONAL RESISTANCE TESTS OF COPPER BAND-METAL.

FRICTIONAL RESISTANCE OF COPPER BAND-METAL.

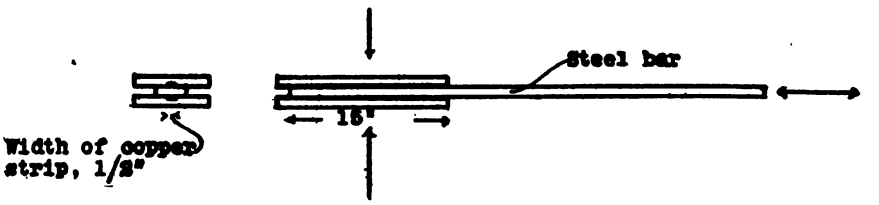
Tests on the frictional resistance of copper upon steel under conditions of high compressive loads were made, using copper representing band-metal of projectiles, and steel bars of the grades used in the construction of guns.

Total loads of 300,000 pounds were applied to the test pieces, which gave a pressure of 40,000 pounds per square inch on the surfaces between which the frictional resistances were determined. The copper was retained in position for the tests in shallow, dovetailed grooves in steel bars, exposing a width of ".5 and length of 15" on each of two bars. Between the retaining bars carrying the copper strips was placed the steel bar, on the opposite sides of which the experimental frictional surfaces were located.

The central steel bar was moved in alternate directions of tension and compression with reference to the action of the testing machine over a distance of ".40. The frictional resistance was observed when the central bar had traveled ".20, ".30, and ".40 in each direction. The frictional surfaces were used without a lubricant.

Observations were repeated with each kind of steel bar, four series of readings generally being taken in both tensile and compressive directions.

FRICTIONAL RESISTANCE TESTS OF COPPER BAND-METAL.



Nickel steel bar loaded between fixtures carrying strips of copper band-metal.

Area of copper, one face, 7.50 square inches.

Applied loads.		Frictional resistance.		Distance traveled.
Total.	Per square inch.	Tensile movement.	Compressive movement.	
Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Inch.*
300,000	40,000	.....	91,000	.20
.....	.....	.....	104,000	.30
.....	.....	.....	121,000	.40
.....	.....	121,000	.....	.20
.....	.....	128,000	.....	.30
.....	.....	134,000	.....	.40
.....	.....	.....	150,000	.20
.....	.....	.....	165,000	.30
.....	.....	.....	175,000	.40
.....	.....	171,000	.....	.20
.....	.....	188,000	.....	.30
.....	.....	195,000	.....	.40

[Rested under 40,000 pounds pressure 1¼ hours.]

300,000	40,000	.....	204,000	.20
.....	.....	.....	210,000	.30
.....	.....	.....	203,000	.40
.....	.....	188,000	.....	.20
.....	.....	204,000	.....	.30
.....	.....	210,000	.....	.40
.....	.....	.....	222,000	.20
.....	.....	.....	246,000	.30
.....	.....	.....	240,000	.40
.....	.....	204,000	.....	.20
.....	.....	250,000	.....	.30
.....	.....	254,000	.....	.40

Copper band-metal elongated in the groove in which it was dovetailed a distance of ″.18 in the top plate; in the lower plate the longitudinal movement was ″.37.

The copper was abraded during the test and minute particles detached. The steel surfaces did not show wear.

Gun steel bar loaded between fixtures carrying strips of copper band-metal. New copper bands used.

Applied loads.		Frictional resistance.		Distance traveled.
Total.	Per square inch.	Tensile movement.	Compressive movement.	
Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Inch.*
300,000	40,000	.....	97,500	.20
.....	.....	.....	109,000	.30
.....	.....	.....	120,800	.40
.....	.....	107,500	.....	.20
.....	.....	119,000	.....	.30
.....	.....	106,000	.....	.40
.....	.....	.....	116,000	.20
.....	.....	.....	116,000	.30
.....	.....	.....	119,600	.40
.....	.....	111,000	.....	.20
.....	.....	117,000	.....	.30
.....	.....	119,700	.....	.40
.....	.....	.....	132,000	.20
.....	.....	.....	138,500	.30
.....	.....	.....	140,900	.40
.....	.....	128,000	.....	.20
.....	.....	126,000	.....	.30
.....	.....	136,200	.....	.40
.....	.....	.....	152,000	.20
.....	.....	.....	155,000	.30
.....	.....	.....	156,800	.40
.....	.....	146,000	.....	.20
.....	.....	153,000	.....	.30
.....	.....	156,600	.....	.40

The copper band-metal elongated in length ″.75 in one groove, in the other ″.94.

The copper was abraded during the test and minute particles detached. The steel surfaces did not show wear.

Midvale steel bar loaded between fixtures carrying strips of copper band-metal. New copper bands used.

Applied loads.		Frictional resistance.		Distance traveled.
Total.	Per square inch.	Tensile movement.	Compressive movement.	
Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Inch.*
300,000	40,000	.....	97,000	.20
.....	.....	.....	105,000	.30
.....	.....	.....	116,600	.40
.....	.....	110,500	.....	.20
.....	.....	119,800	.....	.30
.....	.....	128,000	.....	.40
.....	.....	.....	152,500	.20
.....	.....	.....	166,400	.30
.....	.....	.....	177,000	.40
.....	.....	153,000	.....	.20
.....	.....	161,400	.....	.30
.....	.....	167,000	.....	.40
.....	.....	.....	193,000	.20
.....	.....	.....	201,000	.30
.....	.....	.....	208,600	.40
.....	.....	183,000	.....	.20
.....	.....	193,800	.....	.30
.....	.....	196,500	.....	.40
.....	.....	.....	214,000	.20
.....	.....	.....	227,500	.30
.....	.....	.....	231,400	.40
.....	.....	200,000	.....	.20
.....	.....	210,400	.....	.30
.....	.....	211,000	.....	.40

Gun steel bar returned to the testing machine. Tested with the same copper band-metal in place as used in last test with Midvale steel bar.

Applied loads.		Frictional resistance.		Distance traveled.
Total.	Per square inch.	Tensile movement.	Compressive movement.	
Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Inch.*
300,000	40,000	.....	148,000	.20
.....	.....	.....	173,600	.30
.....	.....	.....	193,000	.40
.....	.....	166,000	.....	.20
.....	.....	182,000	.....	.30
.....	.....	196,000	.....	.40
.....	.....	.....	206,000	.20
.....	.....	.....	237,000	.30
.....	.....	.....	254,000	.40
.....	.....	177,000	.....	.20
.....	.....	227,000	.....	.30
.....	.....	234,800	.....	.40
.....	.....	.....	189,000	.20
.....	.....	.....	261,000	.30
.....	.....	.....	187,000	.40
.....	.....	199,000	.....	.20
.....	.....	182,000	.....	.30
.....	.....	180,000	.....	.40

[Rested under 30,000 pounds per square inch pressure 16 hours.]

300,000	40,000	.....	264,000	.20
.....	.....	.....	270,000	.26
.....	.....	.....	210,000	.30
.....	.....	.....	218,000	.40
.....	.....	186,000	.....	.20
.....	.....	234,000	.....	.30
.....	.....	246,700	.....	.40

Gun steel bar loaded between fixtures carrying strips of metal composed of copper 92.5, nickel 7.5, annealed.

Area of metal strip, one face, 7.50 square inches.

New draw-filed surfaces on steel bar.

Applied loads.		Frictional resistance.		Distance traveled.
Total.	Per square inch.	Tensile movement.	Compressive movement.	
Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Inch.*
300,000	40,000	.....	164,000	.20
.....	.....	.....	201,000	.30
.....	.....	.....	228,000	.40
.....	.....	162,000	.....	.20
.....	.....	224,000	.....	.30
.....	.....	241,400	.....	.40
.....	.....	.....	154,000	.20
.....	.....	.....	258,000	.30
.....	.....	.....	260,000	.40
.....	.....	121,000	.....	.20
.....	.....	199,000	.....	.30
.....	.....	242,000	.....	.40
.....	.....	.....	129,000	.20
.....	.....	.....	224,000	.30
.....	.....	.....	258,000	.40
.....	.....	116,500	.....	.20
.....	.....	192,000	.....	.30
.....	.....	246,200	.....	.40
.....	.....	.....	139,000	.20
.....	.....	.....	226,000	.30
.....	.....	.....	258,000	.40
.....	.....	121,000	.....	.20
.....	.....	196,000	.....	.30
.....	.....	243,500	.....	.40

There were occasional throbs when the higher frictional resistances were encountered. During the last series of observations in a compressive direction, the gun steel bar buckled perceptibly and acquired a permanent set. By reason of this distortion, in the following test the nickel steel bar was substituted for the gun steel distorted one.

No material elongation of the band-metal took place during the test.

Nickel steel bar loaded between fixtures carrying strips of metal composed of copper 82, zinc 18, annealed.

New draw-filed surfaces on steel bar.

Applied loads.		Frictional resistance.		Distance traveled.
Total.	Per square inch.	Tensile movement.	Compressive movement.	
Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Inch.*
300,000	40,000	.....	168,000	.20
.....	.....	.....	194,500	.30
.....	.....	.....	216,500	.40
.....	.....	181,000	.....	.20
.....	.....	213,000	.....	.30
.....	.....	225,400	.....	.40
.....	.....	.....	190,000	.20
.....	.....	.....	249,500	.30
.....	.....	.....	254,000	.40
.....	.....	168,000	.....	.20
.....	.....	227,800	.....	.30
.....	.....	233,800	.....	.40
.....	.....	.....	152,000	.20
.....	.....	.....	251,000	.30
.....	.....	.....	258,200	.40
.....	.....	170,000	.....	.20
.....	.....	227,000	.....	.30
.....	.....	249,200	.....	.40
.....	.....	.....	155,000	.20
.....	.....	.....	241,000	.30
.....	.....	.....	263,000	.40
.....	.....	154,000	.....	.20
.....	.....	218,000	.....	.30
.....	.....	250,000	.....	.40

There were occasional throbs, with fluctuations in frictional resistance displayed throughout the test with this band-metal.

No material elongation of the band-metal took place during the test.

COPPER CYLINDERS FOR PRESSURE GAUGES.

COPPER CYLINDERS FOR PRESSURE GAUGES.

Two series of tables are presented herewith on cylinders of copper and gilding metal, respectively.

In the first series the individual cylinders were loaded progressively up to 60,000 pounds per square inch referred to a pressure gauge of $\frac{1}{30}$ square inch area, taking micrometer observations at intervals of 5,000 pounds each.

The mean compressions are given, and corrected sets to allow for the resilience of the metal.

In the second series of loadings the individual cylinders were each loaded to a prescribed limit. These cylinders were measured before and after loading and the mean difference tabulated with the micrometer measurements of length.

All loads were applied with reference to a crusher gauge of $\frac{1}{30}$ square inch.

Mean compression of 10 cylinders from each of 18 lots from Frankford Arsenal.

Tables for use with crusher gauges one-thirtieth square inch area.

Nine lots of pure copper and nine of gilding metal.

PURE COPPER.

[Nominal dimensions, length, ".3500; diameter, ".2060."]

Load per square inch on one-thirtieth square inch.	Total compressions.											Mean corrected sets.
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Mean.	
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*
1,000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
5,000	.0006	.0005	.0003	.0005	.0003	.0005	.0006	.0009	.0005	.0008	.0006	.0006
10,000	.0037	.0039	.0025	.0036	.0031	.0036	.0038	.0028	.0034	.0034	.0034	.0033
15,000	.0094	.0091	.0079	.0095	.0087	.0088	.0090	.0081	.0085	.0092	.0088	.0086
20,000	.0164	.0160	.0149	.0160	.0158	.0150	.0162	.0150	.0150	.0159	.0156	.0152
25,000	.0243	.0246	.0235	.0243	.0242	.0230	.0244	.0238	.0239	.0224	.0240	.0234
30,000	.0339	.0337	.0325	.0331	.0337	.0324	.0330	.0326	.0327	.0334	.0331	.0323
35,000	.0440	.0438	.0430	.0435	.0440	.0425	.0433	.0420	.0425	.0424	.0431	.0421
40,000	.0540	.0539	.0531	.0543	.0542	.0533	.0537	.0526	.0537	.0536	.0536	.0525
45,000	.0659	.0649	.0651	.0655	.0658	.0648	.0650	.0641	.0652	.0646	.0651	.0640
50,000	.0777	.0762	.0768	.0770	.0779	.0763	.0772	.0765	.0750	.0759	.0767	.0756
55,000	.0890	.0880	.0878	.0886	.0893	.0880	.0880	.0875	.0877	.0885	.0882	.0870
60,000	.1010	.1003	.0991	.1000	.1010	.0995	1000	.0991	.0989	.0994	.0998	.0986

[Nominal dimensions, length, ".4000; diameter, ".2060.]

1,000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
5,000	.0005	.0003	.0003	.0001	.0002	.0006	.0005	.0004	.0004	.0004	.0004	.0004
10,000	.0045	.0045	.0041	.0040	.0045	.0050	.0049	.0044	.0048	.0045	.0045	.0044
15,000	.0105	.0108	.0101	.0104	.0108	.0110	.0104	.0102	.0118	.0101	.0106	.0103
20,000	.0194	.0185	.0172	.0184	.0188	.0197	.0190	.0181	.0190	.0178	.0186	.0181
25,000	.0282	.0280	.0265	.0270	.0288	.0278	.0270	.0273	.0285	.0275	.0277	.0270
30,000	.0380	.0380	.0375	.0376	.0386	.0390	.0388	.0363	.0380	.0379	.0380	.0371
35,000	.0495	.0491	.0490	.0510	.0506	.0481	.0514	.0481	.0500	.0491	.0496	.0485
40,000	.0617	.0606	.0600	.0615	.0619	.0624	.0616	.0611	.0614	.0619	.0614	.0603
45,000	.0743	.0740	.0730	.0750	.0754	.0760	.0750	.0742	.0745	.0750	.0746	.0735
50,000	.0869	.0870	.0860	.0892	.0873	.0890	.0879	.0873	.0879	.0882	.0877	.0865
55,000	.1000	.1010	.0994	.1010	.1000	.1030	.1010	.1005	.1003	.1004	.1007	.0995
60,000	.1132	.1135	.1124	.1142	.1139	.1138	.1145	.1128	.1135	.1134	.1135	.1122

PURE COPPER—Continued.

[Nominal dimensions, length, ".4500; diameter, ".2060.]

Load per square inch on one-thirtieth square inch.	Total compressions.											Mean corrected sets.
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Mean.	
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*
1,000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
5,000	.0008	.0005	.0001	.0005	.0006	.0004	.0008	.0007	.0009	.0005	.0006	.0006
10,000	.0055	.0046	.0039	.0045	.0049	.0041	.0054	.0054	.0050	.0045	.0048	.0047
15,000	.0117	.0110	.0104	.0110	.0100	.0110	.0117	.0115	.0110	.0119	.0111	.0108
20,000	.0220	.0200	.0197	.0198	.0185	.0195	.0211	.0203	.0208	.0200	.0202	.0197
25,000	.0324	.0302	.0298	.0310	.0297	.0320	.0318	.0310	.0307	.0308	.0309	.0302
30,000	.0425	.0416	.0442	.0419	.0425	.0433	.0430	.0421	.0434	.0414	.0426	.0416
35,000	.0546	.0554	.0540	.0545	.0540	.0556	.0547	.0542	.0553	.0542	.0547	.0536
40,000	.0685	.0690	.0675	.0690	.0679	.0684	.0697	.0684	.0690	.0680	.0685	.0674
45,000	.0825	.0830	.0830	.0834	.0821	.0841	.0826	.0848	.0828	.0825	.0831	.0819
50,000	.0965	.0975	.0974	.0975	.0969	.0990	.0978	.0978	.0980	.0967	.0975	.0963
55,000	.1114	.1118	.1120	.1122	.1120	.1137	.1125	.1110	.1125	.1110	.1120	.1107
60,000	.1260	.1272	.1260	.1261	.1275	.1268	.1272	.1265	.1272	.1269	.1267	.1254

[Nominal dimensions, length, ".4000; diameter, ".2260.]

1,000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
5,000	.0005	.0007	.0005	.0004	.0005	.0004	.0005	.0005	.0005	.0006	.0005	.0005
10,000	.0031	.0036	.0029	.0030	.0029	.0030	.0030	.0030	.0035	.0035	.0032	.0031
15,000	.0085	.0088	.0075	.0077	.0077	.0079	.0088	.0078	.0075	.0081	.0080	.0078
20,000	.0134	.0161	.0129	.0130	.0134	.0131	.0145	.0133	.0133	.0137	.0137	.0133
25,000	.0200	.0207	.0200	.0198	.0198	.0198	.0200	.0200	.0200	.0209	.0201	.0196
30,000	.0300	.0300	.0270	.0274	.0274	.0279	.0285	.0274	.0278	.0280	.0281	.0274
35,000	.0380	.0380	.0370	.0357	.0353	.0364	.0390	.0355	.0366	.0364	.0368	.0359
40,000	.0482	.0481	.0480	.0453	.0454	.0458	.0452	.0453	.0462	.0459	.0463	.0453
45,000	.0555	.0574	.0564	.0551	.0557	.0561	.0560	.0553	.0560	.0560	.0560	.0549
50,000	.0669	.0674	.0659	.0659	.0662	.0661	.0675	.0662	.0668	.0657	.0665	.0654
55,000	.0779	.0784	.0781	.0765	.0774	.0774	.0784	.0768	.0774	.0775	.0776	.0764
60,000	.0893	.0889	.0878	.0880	.0876	.0884	.0878	.0874	.0880	.0890	.0882	.0870

[Nominal dimensions, length, ".4500; diameter, ".2260.]

1,000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
5,000	.0007	.0007	.0005	0.	.0005	0.	.0007	.0009	.0003	.0008	.0005	.0005
10,000	.0043	.0043	.0056	.0032	.0035	.0029	.0045	.0055	.0035	.0043	.0042	.0041
15,000	.0094	.0094	.0084	.0090	.0083	.0082	.0094	.0100	.0080	.0094	.0090	.0088
20,000	.0160	.0156	.0147	.0150	.0148	.0144	.0160	.0155	.0147	.0161	.0153	.0149
25,000	.0236	.0229	.0219	.0227	.0225	.0220	.0234	.0229	.0218	.0235	.0227	.0222
30,000	.0323	.0320	.0310	.0315	.0307	.0304	.0321	.0338	.0303	.0324	.0317	.0309
35,000	.0398	.0400	.0404	.0420	.0402	.0400	.0410	.0429	.0402	.0410	.0408	.0398
40,000	.0501	.0500	.0504	.0519	.0500	.0506	.0508	.0510	.0508	.0511	.0507	.0496
45,000	.0608	.0618	.0616	.0622	.0610	.0612	.0614	.0613.	.0613	.0620	.0615	.0604
50,000	.0728	.0725	.0737	.0730	.0735	.0736	.0730	.0748	.0734	.0735	.0734	.0723
55,000	.0846	.0850	.0855	.0860	.0848	.0850	.0849	.0876	.0853	.0860	.0855	.0843
60,000	.0974	.0976	.0979	.0968	.0972	.0989	.0972	.0983	.0978	.0981	.0977	.0965

[Nominal dimensions, length, ".5000; diameter, ".2260.]

1,000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
5,000	.0008	.0005	0.	.0008	.0007	.0006	.0008	.0009	.0006	.0009	.0007	.0007
10,000	.0043	.0032	.0025	.0034	.0037	.0039	.0041	.0039	.0033	.0034	.0036	.0035
15,000	.0100	.0081	.0080	.0094	.0089	.0093	.0096	.0095	.0084	.0110	.0092	.0090
20,000	.0170	.0151	.0148	.0174	.0160	.0166	.0188	.0167	.0159	.0189	.0165	.0161
25,000	.0271	.0242	.0230	.0245	.0245	.0246	.0250	.0248	.0235	.0267	.0248	.0242
30,000	.0340	.0330	.0323	.0344	.0335	.0335	.0346	.0345	.0328	.0343	.0337	.0329
35,000	.0449	.0445	.0435	.0449	.0436	.0434	.0456	.0453	.0430	.0459	.0445	.0435
40,000	.0560	.0558	.0545	.0547	.0542	.0550	.0573	.0570	.0545	.0555	.0555	.0544
45,000	.0681	.0678	.0666	.0679	.0673	.0670	.0695	.0695	.0669	.0673	.0678	.0667
50,000	.0808	.0795	.0800	.0802	.0802	.0805	.0829	.0826	.0798	.0810	.0808	.0796
55,000	.0940	.0930	.0933	.0937	.0933	.0940	.0963	.0950	.0928	.0940	.0939	.0927
60,000	.1070	.1068	.1071	.1081	.1079	.1072	.1084	.1079	.1068	.1073	.1075	.1063

PURE COPPER—Continued.

[Nominal dimensions, length, ".5000; diameter, ".2525.]

Load per square inch on one-thirtieth square inch.	Total compressions.											Mean corrected sets.
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Mean.	
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*
1,000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
5,000	.0004	.0006	.0002	.0004	.0007	.0004	.0004	.0005	.0006	.0005	.0005	.0005
10,000	.0023	.0019	.0018	.0017	.0024	.0021	.0019	.0021	.0022	.0019	.0020	.0019
15,000	.0050	.0066	.0049	.0055	.0063	.0059	.0064	.0068	.0058	.0054	.0059	.0058
20,000	.0093	.0103	.0097	.0103	.0110	.0109	.0108	.0107	.0107	.0104	.0104	.0101
25,000	.0150	.0170	.0165	.0162	.0168	.0164	.0180	.0176	.0166	.0159	.0166	.0162
30,000	.0218	.0230	.0222	.0229	.0234	.0234	.0226	.0237	.0238	.0225	.0229	.0224
35,000	.0287	.0289	.0297	.0298	.0303	.0307	.0322	.0308	.0307	.0293	.0301	.0294
40,000	.0364	.0376	.0367	.0363	.0372	.0398	.0383	.0370	.0389	.0366	.0375	.0366
45,000	.0485	.0466	.0462	.0453	.0454	.0473	.0468	.0458	.0471	.0450	.0464	.0454
50,000	.0546	.0540	.0547	.0555	.0545	.0568	.0573	.0547	.0560	.0542	.0552	.0541
55,000	.0638	.0649	.0644	.0642	.0641	.0669	.0660	.0649	.0652	.0643	.0649	.0638
60,000	.0759	.0745	.0744	.0737	.0743	.0776	.0764	.0751	.0745	.0742	.0751	.0740

[Nominal dimensions, length, ".5500; diameter, ".2525.]

1,000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
5,000	.0006	.0005	.0006	.0005	.0006	.0005	.0007	.0005	.0006	.0005	.0006	.0006
10,000	.0021	.0020	.0021	.0015	.0013	.0018	.0021	.0012	.0020	.0026	.0019	.0018
15,000	.0065	.0059	.0060	.0051	.0051	.0059	.0063	.0051	.0056	.0070	.0059	.0058
20,000	.0122	.0114	.0117	.0108	.0109	.0117	.0117	.0110	.0111	.0124	.0115	.0112
25,000	.0186	.0181	.0185	.0176	.0175	.0184	.0184	.0174	.0179	.0202	.0183	.0178
30,000	.0264	.0257	.0260	.0255	.0250	.0259	.0263	.0250	.0255	.0257	.0257	.0251
35,000	.0348	.0338	.0345	.0330	.0334	.0340	.0347	.0334	.0338	.0351	.0341	.0333
40,000	.0430	.0433	.0430	.0436	.0430	.0432	.0435	.0425	.0428	.0444	.0432	.0422
45,000	.0534	.0529	.0531	.0514	.0523	.0523	.0529	.0520	.0525	.0510	.0524	.0513
50,000	.0639	.0634	.0630	.0627	.0633	.0632	.0638	.0625	.0629	.0635	.0632	.0621
55,000	.0748	.0744	.0731	.0744	.0737	.0729	.0750	.0726	.0744	.0740	.0739	.0728
60,000	.0856	.0854	.0840	.0853	.0855	.0838	.0855	.0838	.0856	.0850	.0850	.0838

[Nominal dimensions, length, ".6000; diameter, ".2525.]

1,000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
5,000	.0006	.0003	.0004	.0004	.0005	.0006	.0007	.0005	.0006	.0005	.0005	.0005
10,000	.0018	.0011	.0012	.0013	.0021	.0027	.0022	.0019	.0021	.0018	.0018	.0017
15,000	.0065	.0054	.0063	.0048	.0077	.0064	.0074	.0078	.0074	.0068	.0067	.0065
20,000	.0126	.0116	.0119	.0107	.0126	.0136	.0130	.0130	.0130	.0131	.0125	.0121
25,000	.0195	.0188	.0189	.0182	.0200	.0204	.0208	.0203	.0206	.0204	.0198	.0193
30,000	.0275	.0267	.0283	.0265	.0280	.0284	.0287	.0290	.0285	.0268	.0278	.0271
35,000	.0368	.0362	.0365	.0353	.0366	.0390	.0377	.0371	.0374	.0385	.0371	.0362
40,000	.0467	.0470	.0468	.0457	.0472	.0451	.0480	.0462	.0474	.0464	.0467	.0457
45,000	.0578	.0569	.0576	.0565	.0580	.0574	.0589	.0563	.0576	.0598	.0577	.0566
50,000	.0679	.0688	.0688	.0679	.0689	.0669	.0694	.0671	.0695	.0691	.0684	.0673
55,000	.0804	.0800	.0814	.0783	.0814	.0788	.0810	.0788	.0817	.0815	.0803	.0791
60,000	.0941	.0937	.0938	.0900	.0962	.0929	.0945	.0905	.0945	.0950	.0935	.0923

Gilding Metal.

[Nominal dimensions, length, ".3500; diameter, ".2060.]

Load per square inch on one-thirtieth square inch.	Total compressions.											Mean corrected sets.
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Mean.	
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*
1,000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
5,000	.0004	.0006	.0004	.0005	.0004	.0004	.0005	.0008	.0004	.0004	.0005	.0005
10,000	.0023	.0020	.0018	.0015	.0027	.0018	.0019	.0024	.0020	.0021	.0021	.0020
15,000	.0089	.0094	.0080	.0075	.0092	.0078	.0085	.0084	.0082	.0084	.0084	.0082
20,000	.0148	.0141	.0141	.0143	.0158	.0145	.0147	.0155	.0155	.0169	.0150	.0146
25,000	.0229	.0230	.0220	.0222	.0244	.0218	.0224	.0233	.0233	.0240	.0229	.0224
30,000	.0305	.0308	.0308	.0300	.0328	.0309	.0310	.0315	.0312	.0325	.0312	.0305
35,000	.0397	.0388	.0385	.0385	.0407	.0377	.0389	.0398	.0393	.0408	.0393	.0383
40,000	.0485	.0481	.0475	.0480	.0522	.0478	.0481	.0480	.0494	.0491	.0487	.0476
45,000	.0566	.0570	.0560	.0568	.0604	.0563	.0568	.0568	.0575	.0585	.0573	.0562
50,000	.0658	.0655	.0656	.0662	.0697	.0653	.0663	.0667	.0664	.0665	.0664	.0653
55,000	.0759	.0755	.0748	.0755	.0787	.0748	.0757	.0754	.0761	.0766	.0759	.0748
60,000	.0846	.0848	.0847	.0844	.0873	.0843	.0853	.0856	.0859	.0857	.0853	.0841

[Nominal dimensions, length, ".4000; diameter, ".2060.]

1,000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
5,000	.0005	.0006	.0007	.0004	.0005	.0008	.0005	.0007	.0009	.0006	.0006	.0006
10,000	.0022	.0035	.0031	.0018	.0024	.0032	.0023	.0032	.0036	.0030	.0028	.0027
15,000	.0094	.0096	.0102	.0075	.0091	.0105	.0094	.0102	.0118	.0100	.0098	.0095
20,000	.0181	.0182	.0188	.0155	.0178	.0187	.0183	.0185	.0200	.0184	.0182	.0177
25,000	.0267	.0280	.0278	.0253	.0266	.0277	.0273	.0280	.0290	.0275	.0274	.0267
30,000	.0359	.0369	.0386	.0347	.0360	.0375	.0368	.0381	.0380	.0376	.0370	.0361
35,000	.0470	.0477	.0485	.0450	.0470	.0475	.0468	.0470	.0485	.0475	.0473	.0462
40,000	.0573	.0579	.0582	.0560	.0571	.0578	.0566	.0575	.0581	.0576	.0574	.0563
45,000	.0669	.0686	.0686	.0663	.0671	.0693	.0672	.0681	.0686	.0679	.0680	.0669
50,000	.0784	.0805	.0790	.0771	.0785	.0796	.0777	.0795	.0800	.0797	.0790	.0778
55,000	.0887	.0910	.0900	.0887	.0885	.0913	.0891	.0900	.0905	.0900	.0898	.0886
60,000	.0995	.1016	.1009	.0997	.1005	.1002	.1000	.1006	.1013	.1015	.1006	.0994

[Nominal dimensions, length, ".4500; diameter, ".2060.]

1,000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
5,000	.0007	.0008	.0008	.0005	.0009	.0008	.0009	.0010	.0008	.0006	.0008	.0008
10,000	.0038	.0040	.0035	.0035	.0037	.0035	.0035	.0039	.0039	.0033	.0037	.0036
15,000	.0132	.0124	.0124	.0116	.0118	.0117	.0118	.0123	.0125	.0114	.0121	.0118
20,000	.0233	.0220	.0220	.0223	.0215	.0218	.0217	.0216	.0220	.0231	.0221	.0216
25,000	.0329	.0325	.0321	.0320	.0308	.0310	.0315	.0318	.0324	.0310	.0318	.0311
30,000	.0438	.0432	.0420	.0425	.0424	.0440	.0428	.0428	.0440	.0419	.0429	.0419
35,000	.0546	.0536	.0540	.0529	.0529	.0538	.0539	.0544	.0538	.0531	.0537	.0526
40,000	.0654	.0652	.0648	.0645	.0645	.0651	.0650	.0650	.0654	.0640	.0649	.0638
45,000	.0786	.0770	.0798	.0760	.0750	.0764	.0768	.0770	.0780	.0770	.0772	.0761
50,000	.0895	.0895	.0887	.0909	.0885	.0887	.0894	.0889	.0893	.0900	.0893	.0881
55,000	.1020	.1028	.1010	.1005	.1005	.1024	.1010	.1000	.1020	.1028	.1015	.1003
60,000	.1152	.1145	.1140	.1134	.1138	.1124	.1135	.1135	.1135	.1141	.1138	.1125

[Nominal dimensions, length, ".4000; diameter, ".2260.]

1,000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
5,000	.0004	.0004	.0004	.0004	.0004	.0004	.0005	.0005	.0005	.0005	.0004	.0004
10,000	.0020	.0020	.0019	.0018	.0015	.0015	.0025	.0017	.0015	.0015	.0018	.0017
15,000	.0077	.0070	.0068	.0069	.0065	.0065	.0077	.0070	.0061	.0065	.0069	.0067
20,000	.0143	.0135	.0133	.0130	.0124	.0130	.0145	.0135	.0125	.0130	.0133	.0129
25,000	.0204	.0204	.0228	.0201	.0195	.0200	.0220	.0209	.0194	.0200	.0206	.0201
30,000	.0276	.0287	.0289	.0278	.0270	.0277	.0290	.0282	.0265	.0271	.0279	.0272
35,000	.0358	.0358	.0369	.0357	.0351	.0360	.0362	.0356	.0340	.0350	.0356	.0348
40,000	.0430	.0444	.0448	.0428	.0436	.0434	.0445	.0438	.0423	.0429	.0436	.0426
45,000	.0520	.0534	.0540	.0523	.0518	.0518	.0533	.0515	.0505	.0520	.0523	.0512
50,000	.0606	.0608	.0626	.0618	.0604	.0609	.0610	.0610	.0596	.0611	.0610	.0599
55,000	.0700	.0693	.0695	.0695	.0695	.0705	.0702	.0699	.0685	.0702	.0697	.0686
60,000	.0781	.0793	.0794	.0789	.0795	.0787	.0795	.0794	.0781	.0794	.0790	.0778

GILDING METAL—Continued.

[Nominal dimensions, length, ".4500; diameter, ".2260.]

Load per square inch on one-thirtieth square inch.	Total compressions.											Mean corrected sets.
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Mean.	
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*
1,000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
5,000	.0006	.0005	.0005	.0005	.0005	.0004	.0005	.0006	.0005	.0005	.0005	.0005
10,000	.0026	.0019	.0015	.0030	.0024	.0018	.0025	.0029	.0028	.0023	.0024	.0023
15,000	.0080	.0076	.0061	.0089	.0087	.0076	.0076	.0079	.0077	.0079	.0078	.0076
20,000	.0151	.0145	.0130	.0148	.0145	.0145	.0146	.0148	.0152	.0148	.0146	.0142
25,000	.0234	.0224	.0211	.0233	.0229	.0223	.0224	.0230	.0225	.0229	.0226	.0221
30,000	.0310	.0310	.0298	.0314	.0320	.0310	.0310	.0310	.0314	.0308	.0310	.0303
35,000	.0395	.0400	.0383	.0397	.0408	.0395	.0395	.0396	.0395	.0396	.0396	.0386
40,000	.0497	.0485	.0479	.0490	.0497	.0500	.0491	.0483	.0487	.0489	.0490	.0479
45,000	.0583	.0585	.0574	.0579	.0586	.0579	.0581	.0582	.0581	.0580	.0581	.0570
50,000	.0690	.0687	.0678	.0678	.0685	.0680	.0679	.0684	.0684	.0687	.0683	.0672
55,000	.0785	.0789	.0776	.0788	.0800	.0784	.0790	.0786	.0786	.0789	.0787	.0775
60,000	.0892	.0891	.0898	.0887	.0896	.0890	.0882	.0890	.0894	.0893	.0891	.0879

[Nominal dimensions, length, " .5000; diameter, " .2260.]

1,000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
5,000	.0003	.0005	.0006	.0005	.0005	.0005	.0005	.0005	.0007	.0005	.0005	.0005
10,000	.0022	.0022	.0023	.0028	.0020	.0018	.0024	.0019	.0028	.0020	.0022	.0021
15,000	.0090	.0090	.0085	.0093	.0076	.0080	.0090	.0087	.0097	.0085	.0087	.0085
20,000	.0170	.0168	.0164	.0173	.0145	.0152	.0174	.0166	.0180	.0158	.0165	.0161
25,000	.0254	.0253	.0250	.0255	.0225	.0234	.0255	.0248	.0267	.0240	.0248	.0242
30,000	.0340	.0338	.0339	.0344	.0319	.0329	.0345	.0340	.0362	.0338	.0339	.0331
35,000	.0444	.0439	.0445	.0440	.0411	.0430	.0441	.0438	.0453	.0426	.0437	.0427
40,000	.0543	.0535	.0544	.0539	.0520	.0518	.0540	.0529	.0539	.0521	.0533	.0522
45,000	.0635	.0641	.0640	.0642	.0621	.0621	.0645	.0634	.0640	.0634	.0635	.0624
50,000	.0752	.0750	.0753	.0778	.0734	.0730	.0753	.0749	.0750	.0745	.0749	.0738
55,000	.0869	.0864	.0849	.0890	.0837	.0844	.0865	.0860	.0859	.0856	.0859	.0847
60,000	.0982	.0984	.0968	.0985	.0964	.0970	.0980	.0981	.0979	.0977	.0977	.0965

[Nominal dimensions, length, ".5000; diameter, ".2525.]

1,000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
5,000	.0007	.0004	0.	.0005	.0005	.0004	.0007	.0006	.0005	.0005	.0005	.0005
10,000	.0018	.0013	.0002	.0013	.0013	.0012	.0018	.0015	.0009	.0014	.0013	.0012
15,000	.0052	.0044	.0020	.0040	.0035	.0031	.0048	.0048	.0031	.0046	.0040	.0039
20,000	.0110	.0110	.0074	.0098	.0084	.0089	.0100	.0104	.0086	.0104	.0096	.0094
25,000	.0166	.0167	.0140	.0152	.0143	.0153	.0160	.0164	.0140	.0160	.0155	.0151
30,000	.0244	.0230	.0204	.0221	.0213	.0222	.0228	.0233	.0205	.0229	.0223	.0218
35,000	.0300	.0319	.0275	.0290	.0280	.0295	.0295	.0308	.0274	.0291	.0293	.0286
40,000	.0390	.0390	.0353	.0356	.0349	.0371	.0369	.0388	.0346	.0370	.0368	.0359
45,000	.0475	.0470	.0430	.0442	.0424	.0445	.0444	.0463	.0421	.0450	.0446	.0436
50,000	.0550	.0550	.0523	.0523	.0498	.0520	.0512	.0539	.0506	.0524	.0525	.0514
55,000	.0631	.0624	.0598	.0608	.0573	.0595	.0589	.0619	.0584	.0606	.0603	.0592
60,000	.0730	.0710	.0688	.0694	.0663	.0683	.0670	.0703	.0670	.0698	.0691	.0680

[Nominal dimensions, length, ".5500; diameter, ".2525.]

1,000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
5,000	.0006	.0005	.0005	.0006	.0006	.0005	.0004	.0004	.0006	.0004	.0005	.0005
10,000	.0017	.0017	.0014	.0016	.0018	.0014	.0015	.0012	.0014	.0020	.0016	.0015
15,000	.0063	.0060	.0051	.0054	.0062	.0051	.0062	.0046	.0060	.0066	.0058	.0057
20,000	.0125	.0124	.0114	.0113	.0127	.0114	.0124	.0110	.0120	.0128	.0120	.0117
25,000	.0190	.0198	.0183	.0183	.0206	.0184	.0195	.0177	.0190	.0205	.0191	.0186
30,000	.0275	.0274	.0258	.0263	.0285	.0262	.0276	.0248	.0260	.0287	.0269	.0263
35,000	.0356	.0352	.0333	.0338	.0360	.0333	.0353	.0329	.0330	.0364	.0345	.0337
40,000	.0438	.0426	.0414	.0418	.0450	.0414	.0437	.0413	.0408	.0446	.0426	.0416
45,000	.0522	.0511	.0504	.0509	.0533	.0500	.0525	.0505	.0498	.0541	.0515	.0504
50,000	.0613	.0591	.0590	.0596	.0619	.0589	.0610	.0589	.0580	.0625	.0600	.0589
55,000	.0707	.0685	.0680	.0691	.0714	.0672	.0695	.0678	.0676	.0723	.0692	.0681
60,000	.0803	.0779	.0768	.0786	.0810	.0759	.0789	.0778	.0783	.0834	.0789	.0777

Gilding Metal—Continued.

[Nominal dimensions, length, ".6000; diameter, ".2525."]

Load per square inch on one-thirtieth square inch.	Total compressions.											Mean corrected sets.
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Mean.	
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*
1,000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
5,000	.0007	.0005	.0002	.0005	.0008	.0005	.0005	.0005	.0005	.0005	.0005	.0005
10,000	.0025	.0014	.0011	.0014	.0019	.0019	.0012	.0017	.0021	.0016	.0017	.0016
15,000	.0063	.0053	.0059	.0051	.0035	.0060	.0048	.0051	.0063	.0051	.0053	.0052
20,000	.0113	.0120	.0126	.0117	.0092	.0128	.0118	.0121	.0130	.0121	.0119	.0116
25,000	.0198	.0198	.0220	.0201	.0165	.0207	.0186	.0193	.0214	.0191	.0197	.0192
30,000	.0289	.0283	.0315	.0276	.0249	.0289	.0274	.0281	.0293	.0279	.0283	.0276
35,000	.0369	.0365	.0379	.0362	.0344	.0370	.0353	.0365	.0389	.0351	.0365	.0356
40,000	.0469	.0458	.0485	.0450	.0438	.0455	.0443	.0450	.0488	.0452	.0459	.0449
45,000	.0564	.0568	.0565	.0554	.0541	.0540	.0531	.0544	.0572	.0539	.0552	.0541
50,000	.0640	.0640	.0690	.0648	.0642	.0643	.0611	.0653	.0666	.0629	.0646	.0635
55,000	.0744	.0752	.0779	.0752	.0737	.0734	.0709	.0749	.0765	.0716	.0744	.0733
60,000	.0847	.0852	.0882	.0853	.0843	.0838	.0816	.0840	.0850	.0828	.0845	.0833

Pure Copper.

[Nominal diameter, ".2060."]

Loads.		Lengths before and after loading, and compression sets.										
Total.	Pounds per square inch on one-thirtieth square inch.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Mean.
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*
0	0	.3503	.3503	.3506	.3503	.3505	.3506	.3504	.3504	.3503	.3506	.....
1,000	30,000	.3186	.3183	.3184	.3186	.3183	.3188	.3186	.3176	.3176	.3174	.....
Compression sets..		.0317	.0320	.0322	.0317	.0322	.0318	.0318	.0328	.0327	.0332	.0322
0	0	.3504	.3503	.3503	.3504	.3502	.3504	.3505	.3507	.3503	.3503	.....
1,333	40,000	.2984	.2964	.2964	.2975	.2969	.2964	.2975	.2976	.2968	.2974	.....
Compression sets..		.0520	.0539	.0539	.0529	.0533	.0540	.0530	.0531	.0535	.0529	.0533
0	0	.3502	.3502	.3507	.3502	.3503	.3505	.3504	.3501	.3503	.3503	.....
1,667	50,000	.2742	.2738	.2751	.2732	.2744	.2744	.2745	.2752	.2738	.2744	.....
Compression sets..		.0760	.0764	.0756	.0770	.0759	.0761	.0759	.0749	.0765	.0759	.0760

[Nominal diameter, ".2060."]

0	0	.3998	.3998	.4000	.4002	.3998	.4003	.4002	.4003	.4001	.4000	.....
1,000	30,000	.3631	.3624	.3643	.3640	.3634	.3638	.3637	.3636	.3635	.3632	.....
Compression sets..		.0367	.0374	.0357	.0362	.0364	.0365	.0365	.0367	.0366	.0368	.0366
0	0	.4002	.3999	.4003	.4000	.4000	.3999	.3999	.4002	.4002	.4002	.....
1,333	40,000	.3401	.3396	.3397	.3403	.3402	.3404	.3393	.3396	.3398	.3400	.....
Compression sets..		.0601	.0603	.0606	.0597	.0598	.0595	.0606	.0606	.0604	.0602	.0602
0	0	.4002	.3999	.4004	.4000	.4003	.4004	.4003	.4003	.4000	.3998	.....
1,667	50,000	.3108	.3136	.3139	.3116	.3125	.3127	.3126	.3136	.3134	.3143	.....
Compression sets..		.0894	.0863	.0865	.0884	.0878	.0877	.0877	.0867	.0 866	0.855	.0873

PURE COPPER—Continued.

[Nominal diameter, ".2060."]

Loads.		Lengths before and after loading, and compression sets.										
Total.	Pounds per square inch on one-thirtieth square inch.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Mean.
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*
0	0	.4504	.4506	.4504	.4506	.4504	.4502	.4505	.4504	.4510	.4504	.....
1,000	30,000	.4081	.4088	.4084	.4096	.4096	.4096	.4088	.4087	.4095	.4096	.....
Compression sets..		.0423	.0418	.0420	.0410	.0408	.0406	.0417	.0417	.0415	.0408	.0414
0	0	.4503	.4504	.4507	.4506	.4502	.4504	.4503	.4503	.4504	.4504	.....
1,333	40,000	.3796	.3812	.3823	.3814	.3807	.3822	.3822	.3821	.3810	.3816	.....
Compression sets..		.0707	.0692	.0684	.0692	.0695	.0682	.0681	.0682	.0694	.0688	.0690
0	0	.4502	.4507	.4503	.4489	.4504	.4506	.4504	.4502	.4504	.4504	.....
1,667	50,000	.3522	.3522	.3531	.3492	.3514	.3525	.3523	.3518	.3515	.3532	.....
Compression sets..		.0980	.0985	.0972	.0997	.0990	.0981	.0981	.0984	.0989	.0972	.0983

[Nominal diameter, ".2260."]

0	0	.4002	.4001	.4001	.4002	.4001	.4002	.4002	.4003	.4001	.4000	.....
1,000	30,000	.3732	.3736	.3734	.3742	.3736	.3737	.3736	.3746	.3726	.3737	.....
Compression sets..		.0270	.0265	.0267	.0260	.0265	.0265	.0266	.0257	.0275	.0263	.0265
0	0	.4001	.4002	.4002	.4001	.4002	.4003	.4002	.4001	.4003	.4001	.....
1,333	40,000	.3565	.3574	.3554	.3562	.3556	.3554	.3559	.3566	.3556	.3568	.....
Compression sets..		.0436	.0428	.0448	.0439	.0446	.0449	.0443	.0435	.0447	.0433	.0440
0	0	.4002	.4002	.4002	.3999	.4001	.4002	.4002	.4000	.4000	.3999	.....
1,667	50,000	.3367	.3357	.3354	.3368	.3366	.3366	.3357	.3364	.3364	.3350	.....
Compression sets..		.0635	.0645	.0648	.0631	.0635	.0636	.0645	.0636	.0636	.0649	.0640

[Nominal diameter, ".2260."]

0	0	.4503	.4502	.4503	.4502	.4502	.4504	.4503	.4503	.4503	.4502	.....
1,000	30,000	.4196	.4194	.4202	.4195	.4203	.4184	.4186	.4188	.4197	.4193	.....
Compression sets..		.0307	.0308	.0301	.0307	.0299	.0320	.0317	.0315	.0306	.0309	.0309
0	0	.4502	.4502	.4509	.4502	.4503	.4503	.4502	.4502	.4502	.4502	.....
1.333	40,000	.3984	.4001	.3996	.4002	.3994	.3998	.3998	.4002	.4003	.4001	.....
Compression sets..		.0518	.0501	.0513	.0500	.0509	.0505	.0504	.0500	.0499	.0501	.0505
0	0	.4503	.4502	.4503	.4501	.4503	.4502	.4501	.4501	.4504	.4503	.....
1,667	50,000	.3769	.3774	.3765	.3764	.3780	.3765	.3766	.3771	.3754	.3770	.....
Compression sets..		.0734	.0728	.0738	.0737	.0723	.0737	.0735	.0730	.0750	.0733	.0735

PURE COPPER—Continued.

[Nominal diameter, ".2260."]

Loads.		Lengths before and after loading, and compression sets.										
Total.	Pounds per square inch on one-thirtieth square inch.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Mean.
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*
0	0	.4998	.4998	.5004	.4999	.4998	.4999	.4999	.5000	.4998	.4999	.....
1,000	30,000	.4666	.4653	.4666	.4655	.4666	.4670	.4664	.4662	.4667	.4664	.....
Compression sets..		.0332	.0345	.0338	.0344	.0332	.0329	.0335	.0338	.0331	.0335	.0336
0	0	.4997	.4999	.4995	.4998	.4996	.5002	.4996	.4996	.4999	.4997	.....
1,333	40,000	.4450	.4437	.4444	.4444	.4442	.4438	.4452	.4440	.4438	.4423	.....
Compression sets..		.0547	.0562	.0551	.0554	.0554	.0564	.0544	.0556	.0561	.0574	.0557
0	0	.4998	.4996	.4998	.4998	.4999	.4998	.4999	.5000	.4998	.4999	.....
1,667	50,000	.4194	.4194	.4203	.4194	.4179	.4192	.4190	.4195	.4183	.4193	.....
Compression sets..		.0804	.0802	.0795	.0804	.0820	.0806	.0809	.0805	.0815	.0806	.0807

[Nominal diameter, ".2525."]

0	0	.4998	.5000	.4998	.4999	.5000	.4999	.5000	.5001	.4999	.5001	.....
1,000	30,000	.4767	.4773	.4766	.4772	.4772	.4777	.4778	.4783	.4774	.4781	.....
Compression sets..		.0231	.0227	.0232	.0227	.0228	.0222	.0222	.0218	.0225	.0220	.0225
0	0	.5001	.4998	.5000	.5000	.4999	.4999	.4998	.5000	.4999	.5000	.....
1,333	40,000	.4626	.4624	.4629	.4626	.4634	.4636	.4624	.4641	.4630	.4631	.....
Compression sets..		.0375	.0374	.0371	.0374	.0365	.0363	.0374	.0359	.0369	.0369	.0369
0	0	.5000	.5000	.5000	.5000	.5001	.5001	.5001	.5001	.4998	.4999	.....
1,667	50,000	.4453	.4467	.4445	.4452	.4466	.4454	.4458	.4469	.4454	.4466	.....
Compression sets..		.0547	.0533	.0555	.0548	.0535	.0546	.0543	.0532	.0544	.0533	.0542

[Nominal diameter, ".2525."]

0	0	.5502	.5494	.5498	.5499	.5497	.5497	.5496	.5496	.5497	.5501	.....
1,000	30,000	.5226	.5215	.5234	.5244	.5243	.5243	.5244	.5244	.5230	.5247	.....
Compression sets..		.0276	.0279	.0264	.0255	.0254	.0254	.0252	.0252	.0267	.0254	.0261
0	0	.5497	.5496	.5499	.5500	.5496	.5503	.5494	.5498	.5496	.5498	.....
1,333	40,000	.5091	.5090	.5089	.5092	.5092	.5094	.5090	.5100	.5097	.5086	.....
Compression sets..		.0406	.0406	.0410	.0408	.0404	.0409	.0404	.0398	.0399	.0412	.0406
0	0	.5498	.5499	.5495	.5498	.5502	.5499	.5498	.5498	.5499	.5500	.....
1,667	50,000	.4892	.4898	.4895	.4902	.4908	.4901	.4902	.4898	.4902	.4904	.....
Compression sets..		.0606	.0601	.0600	.0596	.0594	.0598	.0596	.0600	.0597	.0596	.0598

PURE COPPER—Continued.

[Nominal diameter, ".2525].

Loads.		Lengths before and after loading, and compression sets.										
Total.	Pounds per square inch on one-thirtieth square inch.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Mean.
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*
0	0	.5995	.5996	.6001	.5997	.5997	.5996	.6004	.5994	.5992	.5994	.....
1,000	30,000	.5736	.5723	.5714	.5728	.5734	.5716	.5746	.5686	.5714	.5724	.....
Compression sets..		.0259	.0273	.0287	.0269	.0263	.0280	.0258	.0308	.0278	.0270	.0275
0	0	.5996	.5997	.5996	.5994	.5995	.5992	.5996	.5998	.5998	.5996	.....
1,333	40,000	.5541	.5549	.5550	.5543	.5572	.5544	.5553	.5575	.5553	.5544	.....
Compression sets..		.0455	.0448	.0446	.0451	.0423	.0448	.0443	.0423	.0445	.0452	.0443
0	0	.5998	.5996	.5994	.5994	.5996	.5999	.5999	.5998	.5995	.5996	.....
1,667	50,000	.5343	.5345	.5347	.5332	.5332	.5338	.5354	.5342	.5361	.5329	.....
Compression sets..		.0655	.0651	.0647	.0662	.0664	.0661	.0645	.0656	.0634	.0667	.0654

GILDING METAL.

[Nominal diameter, ".2060.]

0	0	.3496	.3496	.3494	.3502	.3497	.3497	.3497	.3495	.3498	.3501	.....
1,000	30,000	.3196	.3205	.3196	.3194	.3191	.3191	.3195	.3188	.3204	.3203	.....
Compression sets..		.0300	.0291	.0298	.0308	.0306	.0306	.0302	.0307	.0294	.0298	.0301
0	0	.3494	.3497	.3495	.3498	.3498	.3499	.3498	.3496	.3498	.3496	.....
1,333	40,000	.3038	.3037	.3038	.3042	.3034	.3040	.3034	.3022	.3034	.3034	.....
Compression sets..		.0456	.0460	.0457	.0456	.0464	.0459	.0464	.0474	.0464	.0462	.0462
0	0	.3496	.3497	.3496	.3496	.3496	.3500	.3497	.3499	.3499	.3494	.....
1,667	50,000	.2838	.2865	.2861	.2864	.2856	.2851	.2851	.2864	.2857	.2855	.....
Compression sets..		.0658	.0632	.0635	.0632	.0640	.0649	.0646	.0635	.0642	.0639	.0641

[Nominal diameter, ".2060.]

0	0	.4001	.4004	.4002	.3999	.4002	.4004	.4003	.4004	.4001	.4003	.....
1,000	30,000	.3650	.3646	.3642	.3654	.3635	.3659	.3643	.3657	.3654	.3656	.....
Compression sets..		.0351	.0358	.0360	.0345	.0367	.0345	.0360	.0347	.0347	.0347	.0353
0	0	.4003	.4003	.4003	.4002	.3996	.4002	.4003	.4003	.4002	.4003	.....
1,333	40,000	.3453	.3452	.3462	.3456	.3453	.3462	.3453	.3455	.3456	.3455	.....
Compression sets..		.0550	.0551	.0541	.0546	.0543	.0540	.0550	.0548	.0546	.0548	.0546
0	0	.4002	.4002	.4002	.4001	.4000	.4002	.4002	.4003	.4003	.4002	.....
1,667	50,000	.3216	.3233	.3252	.3234	.3245	.3252	.3244	.3230	.3235	.3246	.....
Compression sets..		.0786	.0769	.0750	.0767	.0755	.0750	.0758	.0773	.0768	.0756	.0763

GILDING METAL—Continued.

[Nominal diameter, ".2060."]

Loads.		Lengths before and after loading, and compression sets.										
Total.	Pounds per square inch on one-thirtieth square inch.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Mean.
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*
0	0	.4498	.4497	.4496	.4494	.4496	.4497	.4496	.4496	.4494	.4496	.....
1,000	30,000	.4069	.4076	.4096	.4094	.4105	.4087	.4094	.4086	.4088	.4096	.....
Compression sets..		.0429	.0421	.0400	.0400	.0391	.0410	.0402	.0410	.0406	.0400	.0407
0	0	.4496	.4498	.4494	.4495	.4494	.4499	.4496	.4496	.4496	.4496	.....
1,333	40,000	.3874	.3874	.3867	.3874	.3868	.3874	.3879	.3874	.3874	.3882	.....
Compression sets..		.0622	.0624	.0627	.0621	.0626	.0625	.0617	.0622	.0622	.0614	.0622
0	0	.4494	.4494	.4494	.4494	.4494	.4496	.4495	.4494	.4494	.4494	.....
1,667	50,000	.3643	.3636	.3644	.3646	.3644	.3643	.3646	.3641	.3635	.3640	.....
Compression sets..		.0851	.0858	.0850	.0848	.0850	.0853	.0849	.0853	.0859	.0854	.0853

[Nominal diameter, ".2260."]

0	0	.4002	.4001	.4001	.4001	.4002	.4003	.3998	.4001	.3999	.3998	.....
1,000	30,000	.3735	.3725	.3743	.3738	.3740	.3734	.3742	.3740	.3736	.3734	.....
Compression sets..		.0267	.0276	.0258	.0263	.0262	.0269	.0256	.0261	.0263	.0264	.0264
0	0	.4002	.4004	.4001	.4001	.3997	.3999	.3997	.3997	.4003	.3997	.....
1,333	40,000	.3586	.3586	.3584	.3582	.3579	.3581	.3578	.3583	.3583	.3581	.....
Compression sets..		.0416	.0418	.0417	.0419	.0418	.0418	.0419	.0414	.0420	.0416	.0418
0	0	.3998	.4000	.4000	.3997	.3997	.3998	.3998	.3999	.3999	.3998	.....
1,667	50,000	.3396	.3423	.3417	.3406	.3403	.3417	.3424	.3413	.3423	.3416	.....
Compression sets..		.0602	.0577	.0583	.0591	.0594	.0581	.0574	.0586	.0576	.0582	.0585

[Nominal diameter, ".2260."]

0	0	.4504	.4504	.4506	.4503	.4502	.4504	.4502	.4506	.4502	.4502	.....
1,000	30,000	.4194	.4204	.4192	.4194	.4193	.4204	.4203	.4200	.4191	.4191	.....
Compression sets..		.0310	.0300	.0314	.0309	.0309	.0300	.0299	.0306	.0311	.0311	.0307
0	0	.4503	.4503	.4502	.4503	.4503	.4503	.4503	.4503	.4504	.4503	.....
1,333	40,000	.4022	.4022	.4023	.4027	.4034	.4026	.4032	.4022	.4031	.4034	.....
Compression sets..		.0481	.0481	.0479	.0476	.0469	.0477	.0471	.0481	.0473	.0469	.0476
0	0	.4502	.4503	.4503	.4503	.4503	.4503	.4503	.4502	.4504	.4505	.....
1,667	50,000	.3836	.3842	.3835	.3828	.3823	.3836	.3834	.3835	.3833	.3836	.....
Compression sets..		.0666	.0661	.0668	.0675	.0680	.0667	.0669	.0667	.0671	.0669	.0669

GILDING METAL—Continued.

[Nominal diameter, ".2260."]

Loads.		Lengths before and after loading, and compression sets.										
Total.	Pounds per square inch on one-thirtieth square inch.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Mean.
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*
0	0	.4996	.4997	.4997	.4996	.4997	.4997	.4996	.4997	.4998	.4998	.....
1,000	30,000	.4664	.4658	.4648	.4655	.4643	.4668	.4653	.4654	.4655	.4665	.....
Compression sets..		.0332	.0339	.0349	.0341	.0354	.0329	.0343	.0343	.0343	.0333	.0341
0	0	.4997	.4996	.4998	.4996	.4996	.4998	.4996	.4997	.4997	.4996	.....
1,333	40,000	.4463	.4458	.4475	.4482	.4470	.4464	.4459	.4455	.4464	.4459	.....
Compression sets..		.0534	.0538	.0523	.0514	.0526	.0534	.0537	.0542	.0533	.0537	.0532
0	0	.4997	.4999	.4996	.4996	.4997	.4997	.4997	.4999	.4996	.4997	.....
1,667	50,000	.4252	.4246	.4250	.4254	.4252	.4256	.4256	.4266	.4262	.4267	.....
Compression sets..		.0745	.0753	.0746	.0742	.0745	.0741	.0741	.0733	.0734	.0730	.0741

[Nominal diameter, ".2525."]

0	0	.4997	.4998	.4997	.4997	.4998	.4998	.4998	.4996	.4997	.4994	.....
1,000	30,000	.4787	.4795	.4793	.4786	.4783	.4792	.4787	.4783	.4781	.4776	.....
Compression sets..		.0210	.0203	.0204	.0211	.0215	.0206	.0211	.0213	.0216	.0218	.0211
0	0	.4994	.4996	.4996	.4997	.4996	.4996	.4996	.4997	.4998	.4999	.....
1,333	40,000	.4649	.4651	.4653	.4643	.4632	.4642	.4650	.4651	.4656	.4653	.....
Compression sets..		.0345	.0345	.0343	.0354	.0364	.0354	.0346	.0346	.0342	.0346	.0349
0	0	.4996	.4997	.4997	.4998	.4997	.4996	.4997	.4996	.4998	.4995	.....
1,667	50,000	.4474	.4484	.4496	.4473	.4496	.4494	.4483	.4503	.4482	.4493	.....
Compression sets..		.0522	.0513	.0501	.0525	.0501	.0502	.0514	.0493	.0516	.0502	.0509

[Nominal diameter, ".2525."]

0	0	.5494	.5496	.5494	.5496	.5494	.5496	.5494	.5494	.5494	.5493	.....
1,000	30,000	.5226	.5234	.5234	.5236	.5237	.5212	.5240	.5233	.5226	.5221	.....
Compression sets..		.0268	.0262	.0260	.0260	.0257	.0284	.0254	.0261	.0268	.0272	.0265
0	0	.5496	.5496	.5494	.5495	.5496	.5494	.5494	.5495	.5496	.5495	.....
1,333	40,000	.5104	.5080	.5087	.5094	.5078	.5096	.5069	.5076	.5072	.5073	.....
Compression sets..		.0392	.0416	.0407	.0401	.0418	.0398	.0425	.0419	.0424	.0422	.0412
0	0	.5494	.5494	.5497	.5495	.5495	.5496	.5494	.5494	.5498	.5494	.....
1,667	50,000	.4906	.4920	.4936	.4914	.4902	.4903	.4903	.4903	.4904	.4932	.....
Compression sets..		.0588	.0574	.0561	.0581	.0593	.0593	.0591	.0591	.0594	.0562	.0583

GILDING METAL—Continued.

[Nominal diameter, , ″.2525.]

Loads.		Lengths before and after loading, and compression sets.										
Total.	Pounds per square inch on one-thirtieth square inch.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Mean.
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*
0	0	.6004	.6006	.6005	.6007	.6006	.6005	.6004	.5995	.6006	.6006	.....
1,000	30,000	.5733	.5726	.5744	.5754	.5747	.5717	.5740	.5731	.5733	.5733	.....
Compression sets..		.0271	.0280	.0261	.0253	.0259	.0288	.0264	.0264	.0273	.0273	.0269
0	0	.6005	.6004	.6004	.6004	.6003	.6004	.6004	.6002	.6003	.6002	.....
1,333	40,000	.5579	.5552	.5552	.5549	.5545	.5556	.5542	.5582	.5585	.5553	.....
Compression sets..		.0426	.0452	.0452	.0455	.0458	.0448	.0462	.0420	.0418	.0449	.0444
0	0	.6003	.6000	.6006	.6003	.6002	.6005	.6004	.6003	.6005	.6004	.....
1,667	50,000	.5402	.5350	.5393	.5384	.5373	.5397	.5374	.5383	.5386	.5385	.....
Compression sets..		.0601	.0650	.0613	.0619	.0629	.0608	.0630	.0620	.0619	.0619	.0621

EXPERIMENTS WITH LEAD CYLINDERS.

LEAD CYLINDERS.

COMPRESSION TESTS.

No. 1. Duration of test, 5 minutes 30 seconds.
No. 2. Duration of test, 4 minutes.
No. 3. Duration of test, 8 minutes.
No. 4. Duration of test, 11 minutes.
No. 5. Duration of test, 1 minute.
No. 6. Duration of test, 1 minute.
No. 7. Duration of test, 23 minutes.
No. 8. Cylinder kept under each successive increment 3 minutes, after which reading was taken. Duration of test, 15 minutes.
No. 9. Measurement a taken immediately upon reaching load, b after sustaining load 3 minutes.
No. 10. Advanced at once to load and reading immediately taken.

[Mean dimensions, length, ".6008; diameter, ".3472.]

Total loads applied.	Total compressions.									
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*
40	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
60	.0010	.0002	.0005	.0010	.....	.....	.0009	.....	.....	.....
80	.0030	.0018	.0020	.0032	.....	.....	.0036	.....	.....	.....
100	.0065	.0065	.0050	.0075	.0080	.0085	.0085	.0108	a.0065 b.0097	.....
120	.0107	.0096	.0105	.0126	.....	.....	.0150	.....	.....	.....
140	.0171	.0165	.0155	.0215	.....	.....	.0230	.....	.....	.....
160	.0250	.0225	.0266	.0277	.....	.....	.0340	.....	.....	.....
180	.0347	.0300	.0342	.0397	.....	.....	.0615	.....	.....	.....
200	.0430	.0430	.0465	.0498	.0440	.0440	.0960	.1140	a.0450 b.1120	.....
220	.0521	.0510	.0610	.0623	.....	.....	.1350	.....	.....	.....
240	.0650	.0770	.1090	.1065	.....	.....	.1770	.....	.....	.....
260	.0890	.1200	.1500	.1602	.....	.....	.2140	.....	.....	.....
280	.1189	.1500	.1900	.1945	.....	.....	.2480	.....	.....	.....
300	.1670	.1870	.2250	.2290	.1050	.0900	.2800	.2930	a.1520 b.2920	.....
320	.2070	.2400	.2520	.2566	.....	.....	.3025	.....	.....	.....
340	.2450	.2540	.2735	.2815	.....	.....	.3210	.....	.....	.....
360	.2710	.2800	.2970	.3050	.....	.....	.3360	.....	.....	.....
380	.2910	.2970	.3135	.3170	.....	.....	.3495	.....	.....	.....
400	.3100	.3110	.3280	.3300	.2900	.2500	.3612	.3655	a.3080 b.3615	.....
420	.3230	.3250	.3410	.3415	.....	.....	.3715	.....	.....	.....
440	.3380	.3400	.3515	.3490	.....	.....	.3812	.....	.....	.....
460	.3500	.3490	.3620	.3596	.....	.....	.3895	.....	.....	.....
480	.3575	.3590	.3711	.3680	.....	.....	.3980	.....	.....	.....
500	.3695	.3680	.3800	.3770	.3400	.3200	.4055	.4070	a.3710 b.4045	.3270

EXPERIMENTS WITH LEAD CYLINDERS.

FIRST CYLINDER.

[Original dimensions, length, ".6000; diameter, ".3472.]

Total load applied.	Duration of load.	Length immediately after removing load.	Successive compressions.
Pounds.	*h. m.*	*Inch.*	*Inch.*
0	0 0	.6000	0.
50	Applied and immediately released.	.6000	0.
50	0 1	.5995	.0005
50	0 2	.5995	0.
50	0 5	.5990	.0005
50	0 10	.5990	0.
50	1 0	.5987	.0003
50	16 0	.5970	.0017

SECOND CYLINDER.

[Original dimensions, length, ".6005; diameter, ".3472.]

Total load applied.	Duration of load	Length immediately after removing load.	Successive compressions.
Pounds.	*h. m.*	*Inch.*	*Inch.*
0	0 0	.6005	0.
100	Applied and immediately released.	.5965	.0040
100	0 1	.5930	.0035
100	0 2	.5925	.0005
100	0 5	.5915	.0010
100	0 10	.5910	.0005
100	1 0	.5870	.0040
100	1 0	.5768	.0102
100	1 0	.5736	.0032
100	1 0	.5695	.0041
100	1 0	.5582	.0113
100	1 0	.5545	.0037
100	1 0	.5480	.0065
100	16 0	.5388	.0092
100	24 0	.5361	.0027
100	24 0	.5275	.0086

EXPERIMENTS WITH LEAD CYLINDERS—Continued.

THIRD CYLINDER.

[Original dimensions, length, ".6010; diameter, ".3472.]

Total load applied.	Duration of load.	Length immediately after removing load.	Successive compressions.
Pounds.	*h. m.*	*Inch.*	*Inch.*
0	0 0	.6010	0.
150	Applied and immediately released.	.5823	.0187
150	0 1	.5685	.0138
150	0 2	.5528	.0157
150	0 5	.5408	.0120
150	0 10	.5310	.0098
150	1 0	.4625	.0685
150	1 0	.4420	.0205
150	1 0	.4228	.0192
150	1 0	.4131	.0097
150	1 0	.4074	.0057
150	1 0	.3948	.0126
150	1 0	.3895	.0053
150	16 0	.3448	.0447
150	1 0	.3425	.0023
150	48 0	.3229	.0196

FOURTH CYLINDER.

[Original dimensions, length, ".5983; diameter, ".3475.]

Total load applied.	Duration of load.	Length immediately after removing load.	Successive compressions.
Pounds.	*h. m.*	*Inch.*	*Inch.*
0	0 0	.5983	0.
50	Applied and immediately released.	.5973	.0010
50	1 0	.5960	.0013
50	24 0	.5953	.0007
50	24 0	.5908	.0045
50	24 0	.5902	.0006
50	24 0	.5898	.0004
50	48 0	.5880	.0018

Chemical Analyses.

Metallic fouling from one-half of barrel No. 251125, fired 3,656 rounds.

Received from Springfield Armory.

Copper	grams..	.03273
Nickel	do....	.00628

The above quantities of copper and nickel represent the material found in a solution of King's Norton Metallic Fouling Solvent, representing the material from one-half of the barrel of a small-arms rifle.

Copper ingot received from Rock Island Arsenal.

Copper	99.92

Proof Stresses.

PISTON RODS.

For—	Proof stress applied.
	Pounds.
15-pounder D. S. mounts	131,966
10-inch disappearing carriages	240,000
12-inch disappearing carriages	300,000

WIRE ROPES AND CHAINS.

10-inch disappearing carriages, model 1901	15,000
10-inch disappearing carriages, model 1896	11,000
Wire ropes and sockets for counterbalance device, model 1895	10,000
Counterweight chains	3,640

WHEELS FOR FIELD CARRIAGES AND LIMBERS.

TESTS OF WHEELS FOR 3-INCH CARRIAGES.

Four wheels were received from the Archibald Wheel Company, Lawrence, Mass. The general dimensions were as follows:

Serial No.	Number of spokes.	Depth of felloe.	Diameter of flange bolts.	Thickness of hub flanges.	
				Inner nave box.	Outer nave box.
		Inches.	*Inch.*	*Inch.*	*Inch.*
33	14	2 7/8	9/16	.35	.41
34	14	2 7/8	11/16	.35	.41
35	16	2 7/8	9/16	.50	.40
36	16	2 7/8	9/16	.50	.40

The wheels had one-half-inch tires.

They were loaded in an undishing direction, at one point on the tire, at the bottom of the rim, after the manner shown by the cut in Tests of Metals, 1905, facing page 210. The movement of the rim was observed, abreast the place loaded, under advancing stresses, and sets determined at intervals.

From the details of the tests it appears that the elastic recoveries and permanent sets, after a load of 2,000 pounds was applied and released to the initial load of 200 pounds, were as follows:

Serial No.	Number of spokes.	Elastic recovery.	Permanent set.
		Inch.	*Inch.*
33	14	.75	.17
34	14	.73	.12
35	16	.97	.11
36	16	.97	.11

Continuing the loads, the joints between the spokes and the hub flanges showed perceptible openings, observed on the spokes loaded and on the outside face of the wheel, at the several loads here given:

Serial No.	Number of spokes.	Depth of rim.	Joint perceptibly opened at load of—
		Inches.	*Pounds.*
33	14	2 7/8	3,000
34	14	2 7/8	3,000
35	16	2 7/8	2,500
36	16	2 7/8	3,800

The wheels were finally loaded until the rim movements reached the limits permitted by the testing fixtures. This movement was greater for wheels Nos. 35 and 36 than for the other two, owing to the presence of a bronze hub lining in the wheels of the two higher serial numbers. Under the higher loads, those approaching or exceeding 4,000 pounds, there was long continued yielding without advance of

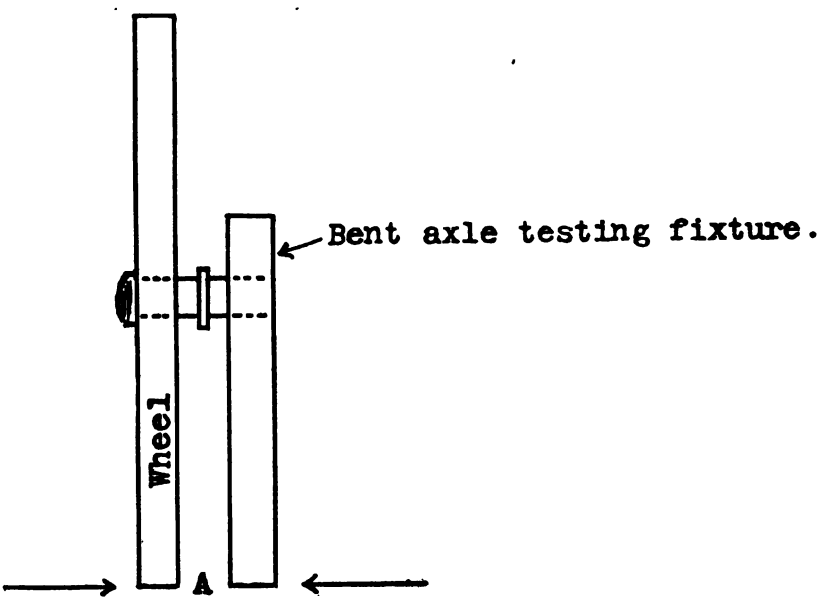
stress, the rim movement not immediately reaching its full amount. At this stage the openings of the joints between the spokes and the outer nave-box flanges were much increased. The flange bolts on the sides of the hubs over the spokes directly loaded appeared to have been slightly stretched by the higher loads of the tests.

The metal of the inner nave-box flanges was permanently distorted, a pronounced effect being caused in flanges which were ".35 thick, and perceptible in the case of the ".50 flanges. These remarks refer to the condition of the metal at the circumference of the flanges. There was also a local distortion of the metal in the vicinity of the bolt holes of the thinner inner flanges, and about the bolt holes of the outer flanges. The metal was drawn down in convex shape on the sides of the flanges next the spokes. Permanent distortion of this kind was not perceptible around the bolt holes of the thicker inner flanges—those which were ".50 thick.

TESTS ON THE RESISTANCE OF WHEELS AGAINST MOVEMENT OF THE RIMS WITH REFERENCE TO THE NAVES.

Wheels loaded at one point on tires, at middle of felloe section and midway two spokes, and on line radially with a flange bolt.

Loads applied in an undishing direction.



Serial No. 33.

14-spoke wheel; sawed felloe, in seven sections, $2\frac{7}{8}$″ deep; $\frac{1}{2}$-inch tire; $\frac{9}{16}$-inch flange bolts.

Thickness of nave box flanges, inner, ″.35; outer, ″.41.

Amount of dishing, ″.67.

Applied loads.	Rim movement at point A.	Remarks.
Pounds.	*Inches.*	
200	0.	Initial load.
500	.12	
800	.24	
1,000	.33	
1,500	.60	
2,000	.92	
200	.17	
2,300	1.11	
2,500	1.26	
2,800	1.50	
3,000	1.67	Opening between lower spokes and edge of outer nave flange, about ″.01 to ″.02.
200	.30	
3,200	1.83	
3,500	2.18	
3,800	2.55	
4,000	2.94	
200	.81	Test discontinued.

Three lower flange bolts permitted of being tightened with 12-inch wrench, the bolt directly abreast the place loaded being the loosest one of the three.

Rim of wheel "ran out" after test, 1″.

Dishing on loaded diameter, ″.52.

Dishing on diameter at right angles to loaded one, ″.62.

Supplementary test made by increasing the rim movement to 5″.08. Load then released, after which the rim "ran out" 2″.20.

Serial No. 34.

14-spoke wheel; sawed felloe, in seven sections, $2\frac{7}{8}$″ deep; $\frac{1}{2}$-inch tire; $\frac{11}{16}$-inch flange bolts.

Thickness of nave box flanges, inner, ″.35; outer, ″.41.

Amount of dishing, ″.69.

Rim "runs out" ″.35.

Applied loads.	Rim movement at point A.	Remarks.
Pounds.	*Inches.*	
200	0.	Initial load.
500	.11	
800	.24	
1,000	.32	
1,500	.58	
2,000	.85	
200	.12	
2,300	1.04	
2,500	1.17	
2,800	1.28	
3,000	1.50	Joint between outer flange and spokes slightly opened.
200	.30	
3,200	1.68	Joint between outer flange and spokes opened about ″.01.
3,500	1.93	
3,800	2.25	
4,000	2.59	
4,000	2.82	After maintaining load 12 minutes.
200	.79	Test discontinued.

Flange bolts were all tight at end of test.

Rim of wheel "runs out" ″.75.

Dishing on loaded diameter, ″.59.

Dishing on diameter at right angles to loaded one, ″.56.

Wheel returned to the testing machine and test resumed.

Applied loads.	Rim movement at point A.	Remarks.
Pounds.	*Inches.*	
200	0.	Initial load. Readings begun again at zero.
2,000	.82	
3,000	1.41	
4,000	2.17	
4,500	3.11	
4,500	3.60	
4,500	4.57	Joint opening between hub flange and spokes, ″.11.
200	.....	Three lower bolts permitted further tightening.

Total rim deflection from initial condition, 5″.21.

Rim appeared to "run out" 1″.70.

Bearing surface of journal showed looseness at end of test, and fit of bearing distorted.

Dishing about ″.29 on two diameters, parallel and at right angles to loaded diameter.

Serial No. 35.

16-spoke wheel; bent rim, in two sections, 2⅛″ deep; ½-inch tire; $\frac{9}{16}$-inch flange bolts.

Thickness of nave box flanges, inner, ″.50; outer, ″.40.

Amount of dishing, ″.77.

Rim "runs out," ″.25.

Applied loads.	Rim movement at point A.	Remarks.
Pounds.	*Inches.*	
200	0.	Initial load.
500	.12	
800	.30	
1,000	.41	
1,500	.72	
2,000	1.08	
200	.11	
2,300	1.31	
2,500	1.52	Joint between outer flange and spokes slightly opened.
2,800	1.82	
3,000	2.06	
200	.28	
3,200	2.35	
3,500	2.72	
3,800	3.76	Maximum resistance shown.
3,500	5.15	
200	2.34	

Flange bolts were all found loose at this stage of the test. Those in lower half of hub, abreast the point loaded, were looser than those in the upper half.

Test completed by increasing the rim movement to 6″.35, after which the wheel was removed from the testing machine.

Rim of wheel "runs out," 2⅝″.

Dishing on loaded diameter, ″.04.

Dishing on diameter at right angles to loaded one, ″.39.

In distorting the wheel, the spokes on the side loaded were drawn outward from between the hub flanges.

Serial No. 36.

16-spoke wheel; sawed felloe, in eight sections, $2\frac{1}{8}''$ deep; $\frac{1}{2}$-inch tire; $\frac{9}{16}$-inch flange bolts.

Thickness of nave box flanges, inner, ".50; outer, ".40.

Amount of dishing, ".75.

Hub cap was tight on thread, but did not come into contact with spring washer.

Applied loads.	Rim movement at point A.	Remarks.
Pounds.	*Inches.*	
200	0.	Initial load.
500	.15	
800	.33	
1,000	.42	
1,500	.74	
2,000	1.08	
200	.11	
2,300	1.30	
2,500	1.48	
2,800	1.76	
3,000	1.96	
200	.36	
3,200	2.20	
3,500	2.62	
3,800	3.16	Joint between outer flange and spokes opened.
4,000	3.74	
200	1.18	Removed from testing machine.

Three lower flange bolts were very slightly stretched by the loads above applied.

Rim "runs out," 1".08.

Returned to the testing machine and loaded until the rim movement reached 6".38, the limit permitted by the testing fixture. Test then discontinued.

The spokes in the lower half of the wheel showed an outward, radial movement and permanent set at the rim of the outer nave box flange. The dishing of the wheel remained reversed to the amount of about ".10.

There was indentation of the wood of the spokes generally displayed at the rims of both nave box flanges.

Further stretching of the flange bolts occurred when passing from a rim movement of 3".74, under 4,000 pounds load, to the maximum movement of 6".38.

After the completion of the tests the nave boxes were removed and examined, and the condition of the wood of the spokes observed at their inner ends.

Effect of Tests on Hub Flanges and Spokes.

No. 33. Inner flange of hub bent outward at the rim, with reference to the spokes, at lower side of wheel—that is, on the side of the wheel which received the load in an undishing direction. The metal about each bolt hole was permanently distorted, being convex on the face of the flange next the spokes.

Outer flange: The inside face of this flange was not disturbed by the test, excepting that the metal was found slightly convex about each of the bolt holes. The convexity extended inward, or toward the spokes.

No. 34. The metal of the inner flange was bent outward at the rim, with reference to the spokes, in the lower part of the hub, and the metal about the bolt holes on this half of the hub was found convex on the side next the spokes. The upper half of the flange was not permanently distorted.

The outer flange was bent outward slightly at the rim and convex inward around each bolt hole, the direction of these movements being described with reference to the spokes, as before.

No. 35. Distortion of the inner flange was slight, and did not reach ".01.

The metal of the outer flange was bent outward at the rim at each part of its circumference, and very pronounced convexity was found about each bolt hole, the metal being distorted inward, or toward the spokes.

No. 36. No local distortion was found in the vicinity of the bolt holes of the inner flange.

A slight disturbance seemed to have taken place about the bolt holes of the outer flange, the metal being bent inward, toward the spoke side of the flange.

Supplementary Measurements on the Hubs.

The distance from a plane parallel to the plane of the inner end of the hub to the rim of the inner flange was measured at four points on each hub—at the bottom, top, and on each quarter.

Hub from wheel No.	Distance at—			
	Bottom.	Top.	First quarter.	Third quarter.
	Inch.	*Inch.*	*Inch.*	*Inch.*
33	.09	0.	.004	.025
34	.07	0.	.025	− .008
35	.008	0.	0.	.006
36	.014	0.	0.	.005

Scarf-welded Steel Tires for 3-inch Field Carriage Wheels.

Specimens received from Archibald Wheel Company, Lawrence, Mass.

TENSILE TESTS.

Marks.	Dimensions at weld.		Sectional area.	Tensile strength.		Appearance.
	Width.	Thickness.		Total.	Per square inch.	
	Inches.	*Inch.*	*Sq. inches.*	*Pounds.*	*Pounds.*	
*	3.03	.50	1.515	88,500	58,420	In part granular and in part following the weld.
**	2.98	.50	1.490	98,200	65,900	Parted along the scarf.
***	3.00	.50	1.500	76,000	50,670	Do.
	3.04	.49	1.490	69,800	46,850	Fractured at end of scarf weld; appearance granular.

Hub Flange Bolts for 3-inch Field Carriage Wheels.

Bolts received from Archibald Wheel Company, Lawrence, Mass.

TENSILE TESTS.

Dimensions.		Threads per inch.	Scale starts off body.	Tensile strength.	Fracture.
Body.	Root of thread.				
Inch.	*Inch.*		*Pounds.*	*Pounds.*	
.75	.62	10	15,800	21,050	Fractured at root of thread. Appearance, fine silky.
.75	.62	10	16,900	22,400	Do.

HUB FLANGE BOLTS FOR 3-INCH FIELD CARRIAGE WHEELS.

Bolts received from Archibald Wheel Company, Lawrence, Mass.
Diameter of specimens, ″.357.
Sectional area, .10 square inch.

TENSILE TESTS.

Sizes of bolts from which specimens were taken.		Elastic limit per square inch.	Tensile strength per square inch.	Elongation in 1 inch.	Contraction of area.	Elongation of inch section.	Appearance of fracture.
Diameter.	Length.						
Inch.	*Inches.*	*Pounds.*	*Pounds.*	*Per cent.*	*Per cent.*	*Inch.*	
5/16	3½	44,000	60,200	25.0	72.0	.25	Fine silky.
5/16	3½	40,500	59,600	23.0	72.0	.23	Do.
5/16	3½	55,000	66,200	38.0	65.0	.38	Do.
5/16	3½	55,000	68,800	36.0	62.0	.36	Do.
½	4	49,500	64,000	38.0	69.0	.38	Do.
½	4	51,000	64,000	38.0	65.0	.38	Do.
½	5	52,000	63,000	39.0	69.0	.39	Do.
½	5	53,000	67,000	40.0	65.0	.40	Do.

HASKELL BOLTS.

Sizes of bolts from which specimens were taken.		Elastic limit per square inch.	Tensile strength per square inch.	Elongation in 2 inches.	Contraction of area.	Elongation of inch section.	Appearance of fracture.
Diameter.	Length.						
Inch.	*Inches.*	*Pounds.*	*Pounds.*	*Per cent.*	*Per cent.*	*Inch.*	
½	.....	50,500	62,500	34.5	64.6	.45*, .24	Fine silky; cup-shaped.
½	.....	47,000	60,500	35.0	66.9	.22, .48*	Do.

CORDAGE.

TENSILE TESTS OF CORDAGE FOR THE UNITED STATES LIGHT-HOUSE ESTABLISHMENT, THIRD DISTRICT, TOMPKINSVILLE, N. Y.

MANILA ROPE.

Samples prepared for testing with eye splices at the ends.
Splices wetted 6 hours before testing.
Length between splices, about 2 feet.

Size.	Number of strands.	Tensile strength.	Parted.
		Pounds.	
6-thread	3	530	2 strands at middle of length.
9-thread	3	950	1 strand at the splice.
12-thread	3	1,340	2 strands 11″ from the splice.
15-thread	3	1,620	1 strand 7″ from the splice.
18-thread	3	1,910	1 strand 10″ from the splice.
21-thread	3	2,450	1 strand 9″ from the splice.
1-inch	3	970	1 strand at the splice.
1½-inch	3	2,410	1 strand 5″ from the splice.
2-inch	4	4,060	2 strands 10″ from the splice.
2½-inch	4	5,810	1 strand at the splice.
3-inch	4	9,780	1 strand 10″ from the splice.

Splices wetted 3 hours before testing.
Length between splices, about 6 feet.

3½-inch	4	11,980	1 strand 18″ from the splice.
4-inch	4	12,000	2 strands at middle of length.
4½-inch	4	13,400	2 strands 8″ from the splice.
5-inch	4	19,600	1 strand 20″ from the splice.
5½-inch	4	22,400	1 strand 6″ from the splice.
6-inch	4	26,950	2 strands 30″ from the splice.
7-inch (coil No. 1)	4	27,200	2 strands 12″ from the splice.

HEMP ROPE.

Samples prepared for testing with eye splices at the ends.
Length between splices, about 2 feet.

Size.	Number of strands.	Tensile strength.	Parted.
		Pounds.	
2½-inch	4	4,320	1 strand at the splice.
3-inch	4	6,350	1 strand 3″ from the splice.
3½-inch	4	6,100	1 strand at the splice.
3½-inch [a]	4	7,680	1 strand at middle of length.

[a] Duplicate test. The first sample of this size had one strand less taut than the others before testing.

Hemp Rope.

Samples prepared for testing with eye splices at the ends.
Length between splices, about 6 feet.

Size.	Number of strands.	Tensile strength.	Parted.
		Pounds.	
2¼-inch		3,960	1 strand 30″ from the splice.
2½-inch		3,800	1 strand at the splice.
3-inch		5,020	1 strand 12″ from the splice.
3-inch		5,540	2 strands at the splice.
3¼-inch		6,950	1 strand 9″ from the splice.
3½-inch		8,420	1 strand 16″ from the splice.

Manila Rope.

Samples prepared for testing with eye splices at the ends.
Length between splices, about 6 feet.
Splices wetted 18 hours before testing.

Size.	Number of strands.	Tensile strength.	Parted.
		Pounds.	
4-inch		11,700	2 strands at middle of length.
4-inch		12,220	Do.
4¼-inch		13,600	Do.
4½-inch		13,900	2 strands 30″ from the splice.
5-inch		25,900	2 strands at middle of length.
5¼-inch		23,600	2 strands 33″ from the splice.
6-inch		29,300	2 strands at middle of length.
6-inch		29,000	2 strands 18″ from the splice.
7-inch		31,200	2 strands at middle of length.
7-inch		32,400	2 strands 30″ from the splice.

Manila Rope.

Samples prepared for testing with eye splices at the ends.
Length between splices, about 5½ feet.
Splices wetted 5 hours before testing.

Size.	Number of strands.	Tensile strength.	Parted.
		Pounds.	
4-inch	4	14,200	1 strand 13″ from the splice.
4½-inch	4	17,900	1 strand 30″ from the splice.
5½-inch	4	28,600	2 strands at middle of length.
6-inch	4	25,800	2 strands 12″ from the splice.
7-inch	4	38,900	2 strands at middle of length.

SPECIMENS FROM LARGER FRAGMENT OF TUBE OF 12-INCH NAVAL GUN NO. 36.

TENSILE TESTS.

Diameter of specimens, ″.505.
Sectional area, .20 square inch.

Direction of specimen.	Elastic limit per square inch.	Tensile strength per square inch.	Elongation.	Contraction of area.	Elongation of inch sections.	Appearance of fracture.
	Pounds.	*Pounds.*	*Per cent.*	*Per cent.*	″ ″	
Tangential	45,000	81,500	26.0	51.9	.25*, .27*	Fine silky.
Do	45,000	81,500	25.5	49.1	.31*, .20	Do.
Longitudinal	43,500	82,000	29.5	57.2	.41*, .18	Do.
Do	42,000	81,500	30.0	59.8	.26, .34*	Do.
Radial	42,500	83,000	29.0	37.1	.29	Silky, oblique.
Do	41,500	82,500	29.0	37.1	.29	Silky.

RAILROAD MATERIAL.

TENSILE TESTS OF SPECIMENS FROM STEEL RAILS FURNISHED BY MR. P. H. DUDLEY.

No. 8409.

Specimen from head.
Marks, H–91.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0003	0.	
10,000	.0005	.....	
30,000	.0020	.....	
40,000	.0028	.....	
45,000	.0032	—.0002	
50,000	.0034	.....	
55,000	.0038	.....	
59,000	.0044	.....	
60,000	.0045	.....	Elastic limit.
61,000	.0052	.....	
62,000	.0058	.....	
63,000	.0065	.....	
64,000	.0072	.....	
65,000	.0084	.....	
69,000	.02	.....	
74,000	.028	.....	
80,000	.035	.....	
85,000	.05	.....	
90,000	.05	.....	
95,000	.06	.....	
100,000	.07	.....	
105,000	.09	.....	
110,000	.12	.....	
116,500	.....	.....	Tensile strength.
0	.35	.....	= 17.5 per cent elongation in 2″.

Elongation of inch sections: ″.17, ″.18.
Diameter at fracture, ″.43; area, .1452 square inch.
Contraction of area, 27.4 per cent.
Fractured at middle of stem.
Appearance of fracture, fine granular; silky spot near circumference.

No. 8410.

Specimen from base.
Marks, B–91.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0003	0.	
10,000	.0008	.....	
30,000	.0020	.....	
40,000	.0027	.....	
50,000	.0033	0.	
.....	.....	.....	Elastic limit between 50,000 and 55,000 pounds per square inch.
55,000	.0050	.0010	
56,000	.0056	.....	
57,000	.0060	.....	
58,000	.0068	.....	
59,000	.0084	.....	
60,000	.0094	.....	
65,000	.0165	.....	
70,000	.025	.....	
80,000	.035	.....	
90,000	.05	.....	
100,000	.07	.....	
115,500	.....	.....	Tensile strength.
0	.35	.....	=17.5 per cent elongation in 2″.

Elongation of inch sections: ″.15, ″.20*.
Diameter at fracture, ″.43; area, .1452 square inch.
Contraction of area, 27.4 per cent.
Fractured 1″ from the neck.
Appearance of fracture, fine granular; silky center.

No. 8411.

Specimen from base.
Marks, B–91.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0003	0.	
10,000	.0007	.....	
30,000	.0020	.....	
40,000	.0026	.....	
45,000	.0030	.....	
50,000	.0031	0.	
55,000	.0035	.....	
56,000	.0036	.....	Elastic limit.
57,000	.0042	.....	
58,000	.0067	.....	
59,000	.0083	.....	
60,000	.0094	.....	
65,000	.0155	.....	
70,000	.0210	.....	
80,000	.035	.....	
90,000	.05	.....	
100,000	.07	.....	
110,000	.12	.....	
116,000	.....	.....	Tensile strength.
0	.36	.....	= 18 per cent elongation in 2″.

Elongation of inch sections: ″.20*, ″.16.
Diameter at fracture, ″.43; area, .1452 square inch.
Contraction of area, 27.4 per cent.
Fractured 1″.15 from the neck.
Appearance of fracture, fine granular; silky center.

No. 8412.

Specimen from head.
Marks, H–91.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0003	0.	
10,000	.0006	.....	
30,000	.0020	.....	
40,000	.0030	.....	
45,000	.0035	.0003	
50,000	.0039	.0006	
53,000	.0043	.....	
54,000	.0044	.....	Elastic limit.
55,000	.0059	.....	
56,000	.0065	.....	
57,000	.0077	.....	
58,000	.0087	.....	
59,000	.0099	.....	
60,000	.0108	.....	
65,000	.0168	.....	
70,000	.0230	.....	
80,000	.05	.....	
90,000	.06	.....	
100,000	.085	.....	
110,000	.11	.....	
115,500	.....	.....	Tensile strength.
0	.36	.....	= 18 per cent elongation in 2″.

Elongation of inch sections: ″.18, ″.18*.
Diameter at fracture, ″.42; area, .1385 square inch.
Contraction of area, 30.7 per cent.
Fractured 1″.20 from the neck.
Appearance of fracture, fine granular; silky center.

No. 8413.

Specimen from head.
Marks, H–91.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0003	0.	
10,000	.0005	.....	
30,000	.0019	.....	
40,000	.0025	.....	
45,000	.0030	0.	
50,000	.0036	.0003	
52,000	.0040	.....	
53,000	.0042	.....	
54,000	.0045	.....	
55,000	.0047	.....	Elastic limit.
56,000	.0054	.....	
57,000	.0062	.....	
58,000	.0070	.....	
59,000	.0079	.....	
60,000	.0089	.....	
65,000	.0134	.....	
70,000	.0206	.....	
80,000	.04	.....	
90,000	.06	.....	
100,000	.08	.....	
110,000	.13	.....	
115,500	.....	.....	Tensile strength.
0	.36	.....	= 18 per cent elongation in 2″.

Elongation of inch sections: ″.15, .21*.
Diameter at fracture, ″.43; area, .1452 square inch.
Contraction of area, 27.4 per cent.
Fractured 1″.28 from the neck.
Appearance of fracture, fine granular; silky center.

No. 8414.

Specimen from head.
Marks, H–91.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0003	0.	
10,000	.0005	.....	
30,000	.0020	.....	
40,000	.0025	.....	
45,000	.0030	0.	
50,000	.0034	0.	
51,000	.0035	.....	
52,000	.0037	.....	
53,000	.0039	.....	
54,000	.0041	.....	Elastic limit.
55,000	.0053	.....	
56,000	.0060	.....	
57,000	.0070	.....	
58,000	.0079	.....	
59,000	.0095	.....	
60,000	.0107	.....	
65,000	.0155	.....	
70,000	.0225	.....	
80,000	.04	.....	
90,000	.06	.....	
100,000	.07	.....	
110,000	.12	.....	
115,000	.....	.....	Tensile strength.
0	.37	.....	=18.5 per cent elongation in 2″.

Elongation of inch sections, ″.16, ″.21*.
Diameter at fracture, ″.43; area, .1452 square inch.
Contraction of area, 27.4 per cent.
Fractured 1″.06 from the neck.
Appearance of fracture, fine granular; silky center.

TABULATION OF TENSION SPECIMENS FROM STEEL RAILS.

Diameter of specimens, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Number of test.	Marks.	Location of specimen.	Elastic limit per square inch.	Tensile strength per square inch.	Elongation in 2 inches.	Contraction of area.	Elongation of inch sections.	Appearance of fracture.
			Pounds.	*Pounds.*	*Per cent.*	*Per ct.*	″ ″	
8409...	H–91....	Head.	60,000	116,500	17.5	27.4	.17, .18	Fine granular; silky spot.
8410...	B–91....	Base..	(a)	115,500	17.5	27.4	.15, .20*	Fine granular; silky center.
8411...	B–91....	...do..	56,000	116,000	18.0	27.4	.20*, .16	Do.
8412...	H–91....	Head.	54,000	115,500	18.0	30.7	.18, .18*	Do.
8413...	H–91....	...do..	55,000	115,500	18.0	27.4	.15, .21*	Do.
8414...	H–91....	...do..	54,000	115,000	18.5	27.4	.16, .21*	Do.

a Between 50,000 and 55,000 pounds per square inch.

ENDURANCE OF ROTATING SHAFTS.

No. 388.

Marks, .82 C.
Gautier steel bar; 0.82 per cent carbon. Hot-rolled bar.
Diameter, 1″. Speed of rotation, 500 per minute.
Length between end supports, 33″.
Loaded over 4″ length at middle.
Deflections measured on chord of 10″.

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
40,000	.....	58,140,720	.....	.....	.....	.....	.....	.....	Reported in 1904.
40,000	45,062,670	103,203,390	.....	.....	.....	.....	.....	.....	Reported in 1905.
40,000	56,808,940	160,012,330	.....	.....	.....	.....	.....	.....	Reported in 1906.
40,000	41,987,670	202,000,000	.....	.....	.....	.....	.....	.....	Bar not ruptured. Removed from testing machine.

No. 405.

Marks, 1.09 C.
Gautier steel bar; 1.09 per cent carbon. Hot-rolled bar.
Diameter, 1″. Speed of rotation, 500 per minute.
Length between end supports, 33″.
Loaded over 4″ length at middle.
Deflections measured on chord of 10″.

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
35,000	.....	12,876,430	.....	.....	.....	.....	.....	.....	Reported in 1905.
35,000	57,424,290	70,300,720	.....	.....	.....	.....	.....	.....	Reported in 1906.
35,000	69,599,610	139,900,330	.....	.....	.....	.....	.....	.....	Bar not ruptured. Still running.

No. 411.

Marks, T-65.
Railroad rail head.
Diameter, 1″. Speed of rotation, 500 per minute.
Length between end supports, 33″.
Loaded over 4″ length at middle.
Deflections measured on chord of 10″.

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
40,000	.....	57,925,460	.....	.....	.....	.....	.....	.....	Reported in 1906.
40,000	20,482,130	78,407,590	a	.1560	.1228	.1559	.0331	.0001	
	.....	.....	b	.1560	.1228	.1560	.0332	0.	
45,000	0	78,407,590	a	.1560	.1187	.1560	.0373	0.	
	.....	.....	b	.1560	.1189	.1559	.0370	.0001	
45,000	100	78,407,690	a	.1560	.1184	.1560	.0376	0.	
	.....	.....	b	.1561	.1191	.1560	.0369	.0001	
45,000	1,000	78,408,690	a	.1560	.1182	.1560	.0378	0.	
	.....	.....	b	.1561	.1189	.1560	.0371	.0001	
45,000	10,000	78,418,690	a	.1561	.1182	.1560	.0378	.0001	
	.....	.....	b	.1561	.1187	.1560	.0373	.0001	
50,000	0	78,418,690	a	.1562	.1145	.1559	.0414	.0003	
	.....	.....	b	.1562	.1142	.1559	.0417	.0003	
50,000	100	78,418,790	a	.1559	.1138	.1559	.0421	0.	
	.....	.....	b	.1563	.1143	.1558	.0415	.0005	
50,000	1,000	78,419,790	a	.1563	.1146	.1560	.0414	.0003	
	.....	.....	b	.1561	.1142	.1558	.0416	.0003	
50,000	10,000	78,429,790	a	.1562	.1145	.1559	.0414	.0003	
	.....	.....	b	.1562	.1142	.1557	.0415	.0005	
50,000	208,430	78,638,220	a	.1565	.1138	.1560	.0422	.0005	
	.....	.....	b	.1562	.1135	.1558	.0423	.0004	
55,000	0	78,638,220	a	.1564	.1095	.1554	.0459	.0010	
	.....	.....	b	.1562	.1096	.1555	.0460	.0007	
55,000	100	78,638,320	a	.1565	.1095	.1555	.0460	.0010	
	.....	.....	b	.1565	.1092	.1555	.0463	.0010	
55,000	1,000	78,639,320	a	.1568	.1096	.1557	.0461	.0011	
	.....	.....	b	.1565	.1097	.1554	.0457	.0011	
55,000	10,000	78,649,320	a	.1562	.1093	.1555	.0462	.0007	
	.....	.....	b	.1566	.1095	.1553	.0458	.0013	
55,000	155,150	78,804,470	a	.1558	.1094	.1555	.0461	.0003	
	.....	.....	b	.1567	.1095	.1554	.0459	.0013	
60,000	0	78,804,470	a	.1568	.1052	.1553	.0501	.0015	
	.....	.....	b	.1570	.1050	.1550	.0500	.0020	
60,000	100	78,804,570	a	.1567	.1052	.1552	.0500	.0015	
	.....	.....	b	.1570	.1051	.1549	.0498	.0021	
60,000	1,000	78,805,570	a	.1575	.1042	.1552	.0510	.0023	
	.....	.....	b	.1570	.1045	.1547	.0502	.0023	
60,000	10,000	78,815,570	a	.1549	.1039	.1543	.0504	.0006	
	.....	.....	b	.1577	.1043	.1545	.0502	.0032	
60,000	100,000	78,915,570	a	.1583	.1048	.1549	.0501	.0034	
	.....	.....	b	.1572	.1043	.1541	.0498	.0031	
60,000	91,600	79,007,170	.....	.....	.....	.....	.....	.....	Bar ruptured 1¼″ south of the south edge of north middle bearing.

No. 412.

Marks, .34 C.
Gautier steel bar; 0.34 per cent carbon. Hot-rolled bar.
Diameter, 1″. Speed of rotation, 500 per minute.
Length between end supports, 33″.
Loaded over 4″ length at middle.
Deflections measured on chord of 10″.

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
40,000	.....	35,061,500	.....	.....	.....	.....	.....	.....	Reported in 1906.
40,000	28,371,200	63,432,700	.....	.....	.....	.....	.....	.....	Bar run hot; middle bearings melted. Bar scored at center from head of screw that holds up middle bearing fixture; bar also scored at the south middle bearing. New bearings put in and test resumed.
40,000	234,620	63,667,320	.....	.....	.....	.....	.....	.....	Bar ruptured midway between middle bearings, at a score mark made by head of screw which holds up middle bearing fixture.

No. 413.

Marks, AM–834–10–2.
Amorphous steel bar.
Diameter, 1″. Speed of rotation, 500 per minute.
Length between end supports, 33″.
Loaded over 4″ length at middle.
Deflections measured on chord of 10″.

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
40,000	0	0	a	.1566	.1239	.1566	.0327	0.	
	.....	.....	b	.1568	.1228	.1560	.0332	.0008	
40,000	1,000	1,000	a	.1580	.1245	.1578	.0333	.0002	
	.....	.....	b	.1557	.1221	.1555	.0334	.0002	Bar running hot.
40,000	10,000	11,000	a	.1580	.1247	.1580	.0333	0.	
	.....	.....	b	.1555	.1224	.1553	.0329	.0002	
40,000	100,000	111,000	a	.1582	.1254	.1582	.0328	0.	
	.....	.....	b	.1552	.1220	.1551	.0331	.0001	
40,000	138,170	249,170	a	.1583	.1250	.1583	.0333	0.	
	.....	.....	b	.1551	.1220	.1549	.0329	.0002	

No. 413—Continued.

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
40,000	0	249,170	a	.1587	.1257	.1584	.0327	.0003	After resting 24 hours. Bar bent to one side.
	.....	.....	b	.1551	.1220	.1550	.0330	.0001	
40,000	213,040	462,210	a	.1585	.1252	.1585	.0333	0.	
	.....	.....	b	.1555	.1220	.1554	.0334	.0001	
40,000	37,790	500,000	a	.1585	.1255	.1585	.0330	0.	
	.....	.....	b	.1551	.1218	.1549	.0331	.0002	
45,000	0	500,000	a	.1586	.1210	.1584	.0374	.0002	
	.....	.....	b	.1551	.1177	.1549	.0372	.0002	
45,000	1,000	501,000	a	.1586	.1211	.1584	.0373	.0002	
	.....	.....	b	.1550	.1182	.1549	.0367	.0001	
45,000	10,000	511,000	a	.1586	.1213	.1584	.0371	.0002	
	.....	.....	b	.1550	.1180	.1549	.0369	.0001	
45,000	89,000	600,000	a	.1586	.1212	.1585	.0373	.0001	
	.....	.....	b	.1550	.1174	.1548	.0374	.0002	
45,000	2,800	602,800	.....	.....	.....	.....	.....	.....	
50,000	0	602,800	a	.1587	.1172	.1585	.0413	.0002	
	.....	.....	b	.1550	.1138	.1546	.0408	.0004	
50,000	1,000	603,800	a	.1588	.1174	.1587	.0413	.0001	
	.....	.....	b	.1551	.1137	.1548	.0411	.0003	
50,000	10,000	613,800	a	.1585	.1168	.1585	.0417	0.	
	.....	.....	b	.1549	.1130	.1545	.0415	.0004	
50,000	100,000	713,800	a	.1595	.1181	.1594	.0413	.0001	
	.....	.....	b	.1542	.1128	.1538	.0410	.0004	
50,000	16,400	730,200	.....	.....	.....	.....	.....	.....	
55,000	0	730,200	a	.1597	.1136	.1595	.0459	.0002	
	.....	.....	b	.1542	.1091	.1538	.0447	.0004	
55,000	1,000	731,200	a	.1596	.1138	.1594	.0456	.0002	
	.....	.....	b	.1543	.1084	.1537	.0453	.0006	
55,000	9,000	740,200	a	.1597	.1141	.1595	.0454	.0002	
	.....	.....	b	.1542	.1078	.1538	.0460	.0004	
55,000	90,000	830,200	a	.1607	.1148	.1603	.0455	.0004	
	.....	.....	b	.1533	.1078	.1526	.0448	.0007	
60,000	0	830,200	a	.1609	.1105	.1602	.0497	.0007	
	.....	.....	b	.1534	.1045	.1525	.0490	.0009	
60,000	1,000	831,200	a	.1601	.1103	.1600	.0497	.0001	
	.....	.....	b	.1535	.1040	.1526	.0486	.0009	
60,000	10,000	841,200	a	.1611	.1107	.1602	.0495	.0009	
	.....	.....	b	.1534	.1042	.1525	.0483	.0009	
60,000	100,000	941,200	a	.1623	.1114	.1612	.0498	.0011	
	.....	.....	b	.1526	.1013	.1512	.0499	.0014	
60,000	144,260	1,085,460	.....	.....	.....	.....	.....	.....	Bar ruptured ".50 north of the north edge of south middle bearing.

No. 414.

Marks, SO–90–2–11.
Sorbitic steel bar.
Diameter, 1″. Speed of rotation, 500 per minute.
Length between end supports, 33″.
Loaded over 4″ length at middle.
Deflections measured on chord of 10″.

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
40,000	0	0	a	.1569	.1235	.1567	.0332	.0002	
	.....	.....	b	.1571	.1253	.1569	.0316	.0002	
40,000	1,000	1,000	a	.1566	.1235	.1566	.0331	0.	
	.....	.....	b	.1573	.1252	.1570	.0318	.0003	
40,000	10,000	11,000	a	.1564	.1230	.1564	.0334	0.	
	.....	.....	b	.1573	.1250	.1571	.0321	.0002	
40,000	100,000	110,000	a	.1564	.1231	.1563	.0332	.0001	
	.....	.....	b	.1574	.1245	.1573	.0328	.0001	
40,000	389,000	500,000	a	.1565	.1233	.1564	.0331	.0001	
	.....	.....	b	.1573	.1250	.1572	.0322	.0001	
45,000	0	500,000	a	.1565	.1190	.1563	.0373	.0002	
	.....	.....	b	.1575	.1200	.1572	.0372	.0003	
45,000	1,000	501,000	a	.1565	.1192	.1564	.0372	.0001	
	.....	.....	b	,1574	.1205	.1572	.0367	.0002	
45,000	10,000	511,000	a	.1564	.1190	.1563	.0373	.0001	
	.....	.....	b	.1575	.1205	.1572	.0367	.0003	
45,000	89,000	600,000	a	.1563	.1194	.1563	.0369	0.	
	.....	.....	b	.1575	.1200	.1573	.0373	.0002	
50,000	0	600,000	a	.1565	.1156	.1563	.0407	.0002	
	.....	.....	b	.1575	.1172	.1573	.0401	.0002	
50,000	1,000	601,000	a	.1560	.1145	.1560	.0415	0.	
	.....	.....	b	.1577	.1167	.1574	.0407	.0003	
50,000	10,000	611,000	a	.1560	.1151	.1560	.0409	0.	
	.....	.....	b	.1578	.1160	.1575	.0415	.0003	
50,000	89,000	700,000	a	.1558	.1145	.1558	.0413	0.	
	.....	.....	b	.1581	.1171	.1578	.0407	.0003	
55,000	0	700,000	a	.1562	.1108	.1558	.0450	.0004	
	.....	.....	b	.1581	.1140	.1577	.0437	.0004	
55,000	1,000	701,000	a	.1563	.1107	.1558	.0451	.0005	
	.....	.....	b	.1581	.1135	.1577	.0442	.0004	
55,000	10,000	711,000	a	.1549	.1097	.1549	.0452	0.	
	.....	.....	b	.1589	.1140	.1578	.0438	.0011	
55,000	89,000	800,000	a	.1568	.1088	.1548	.0460	.0020	
	.....	.....	b	.1593	.1123	.1572	.0449	.0021	
60,000	0	800,000	a	.1565	.1050	.1545	.0495	.0020	
	.....	.....	b	.1595	.1085	.1573	.0488	.0022	
60,000	1,000	801,000	a	.1563	.1047	.1543	.0496	.0020	
	.....	.....	b	.1599	.1086	.1573	.0487	.0026	
60,000	10,000	811,000	a	.1575	.1040	.1538	.0498	.0037	
	.....	.....	b	.1598	.1075	.1565	.0490	.0033	
60,000	65,570	876,570	.....	.....	.....	.....	.....	.....	Bar ruptured 1″.20 south of the south edge of north middle bearing.

No. 415.

Marks, AM–834–10–1.
Amorphous steel bar.
Diameter, 1″. Speed of rotation, 500 per minute.
Length between end supports, 33″.
Loaded over 4″ length at middle.
Deflections measured on chord of 10″.

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
40,000	0	0	a	.1573	.1239	.1570	.0331	.0003	
			b	.1573	.1255	.1571	.0316	.0002	
40,000	1,000	1,000	a	.1572	.1240	.1571	.0331	.0001	
			b	.1574	.1250	.1572	.0322	.0002	
40,000	10,000	11,000	a	.1570	.1235	.1570	.0335	0.	
			b	.1575	.1247	.1573	.0326	.0002	
40,000	89,000	100,000	a	.1570	.1241	.1570	.0329	0.	
			b	.1574	.1250	.1573	.0323	.0001	
40,000	45,286,500	45,386,500							Bar not ruptured. Still running.

No. 416.

Marks, SO–1–98A–11.
Sorbitic steel bar.
Diameter, 1″. Speed of rotation, 500 per minute.
Length between end supports, 33″.
Loaded over 4″ length at middle.
Deflections measured on chord of 10″.

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.			*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
40,000	0	0	a	.1582	.1252	.1581	.0329	.0001	
			b	.1586	.1251	.1582	.0331	.0004	
40,000	1,000	1,000	a	.1587	.1258	.1585	.0327	.0002	
			b	.1581	.1255	.1580	.0325	.0001	
40,000	10,000	11,000	a	.1590	.1260	.1590	.0330	0.	Bar run hot.
			b	.1574	.1244	.1571	.0327	.0003	
40,000	89,000	100,000	a	.1593	.1264	.1590	.0326	.0003	
			b	.1576	.1245	.1574	.0329	.0002	
40,000	37 425.170	37,525,170							Bar not ruptured. Still running.

No. 417.

Marks, .73 C.
Gautier steel bar; 0.73 per cent carbon. Hot-rolled bar.
Diameter, 1″. Speed of rotation, 500 per minute.
Length between end supports, 33″
Loaded over 4″ length at middle.
Deflections measured on chord of 10″.

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds				*Inch.*	*Inch*	*Inch.*	*Inch.*	*Inch.*	
40,000	0	0	a	.1573	.1250	.1573	.0323	0.	
			b	.1575	.1253	.1575	.0322	0.	
40,000	1,000	1,000	a	.1572	.1248	.1572	.0324	0.	
			b	.1575	.1253	.1575	.0322	0.	
40,000	9,000	10,000	a	.1573	.1247	.1573	.0326	0.	
			b	.1575	.1250	.1575	.0325	0.	
40,000	90,000	100,000	a	.1573	.1250	.1573	.0323	0.	
			b	.1575	.1250	.1575	.0325	0.	
40,000	23,913,050	24,013,050							Bar not ruptured. Still running.

ENDURANCE OF ROTATING SHAFTS.

SUMMARIZED TABULATION.

Speed of rotation, 500 per minute.

No. of test.	Marks.	Material.	Treatment.	Composition.				Maximum fiber stress per square inch.	Number of rotations.		Remarks.
				C.	Mn.	Si.	Ni.		Successive.	Total.	
								Pounds.			
388	.82C	Gautier steel	Hot-rolled bar	0.82	0.36	0.10	.....	40,000	.....	202,000,000	Bar not ruptured.
405	1.09C	do	do	1.09	.39	.11	.....	35,000	.....	139,900,330	Do.
411	T-65	Railroad rail head	.....	.410	.787	.065	.....	40,000	78,407,590	78,407,590	
								45,000	11,100	78,418,690	
								50,000	219,530	78,638,220	
								55,000	166,250	78,804,470	
								60,000	202,700	79,007,170	Ruptured between middle bearings.
412	.34C	Gautier steel	Hot-rolled bar	.34	.65	.34	.....	40,000	.....	63,667,320	Do.
413	AM-834-10-2	Amorphous steel bar	.....	.30	.085	.103	3.42	40,000	500,000	500,000	
								45,000	102,800	602,800	
								50,000	127,400	730,200	
								55,000	100,000	830,200	
								60,000	255,260	1,085,460	Do.
414	SO-90-2-11	Sorbitic steel bar	.....	.343	.660	.197	.....	40,000	500,000	500,000	
								45,000	100,000	600,000	
								50,000	100,000	700,000	
								55,000	100,000	800,000	
								60,000	76,570	876,570	Do.
415	AM-834-10-1	Amorphous steel bar	.....	.30	.085	.103	3.42	40,000	.....	45,386,500	Bar not ruptured
416	SO-1-98A-11	Sorbitic steel bar	.....	.343	.660	.197	.....	40,000	.....	37,525,170	Do.
417	.73C	Gautier steel bar	Hot-rolled bar	.73	.64	.04	.....	40,000	.....	24,013,050	Do.

CEMENT.

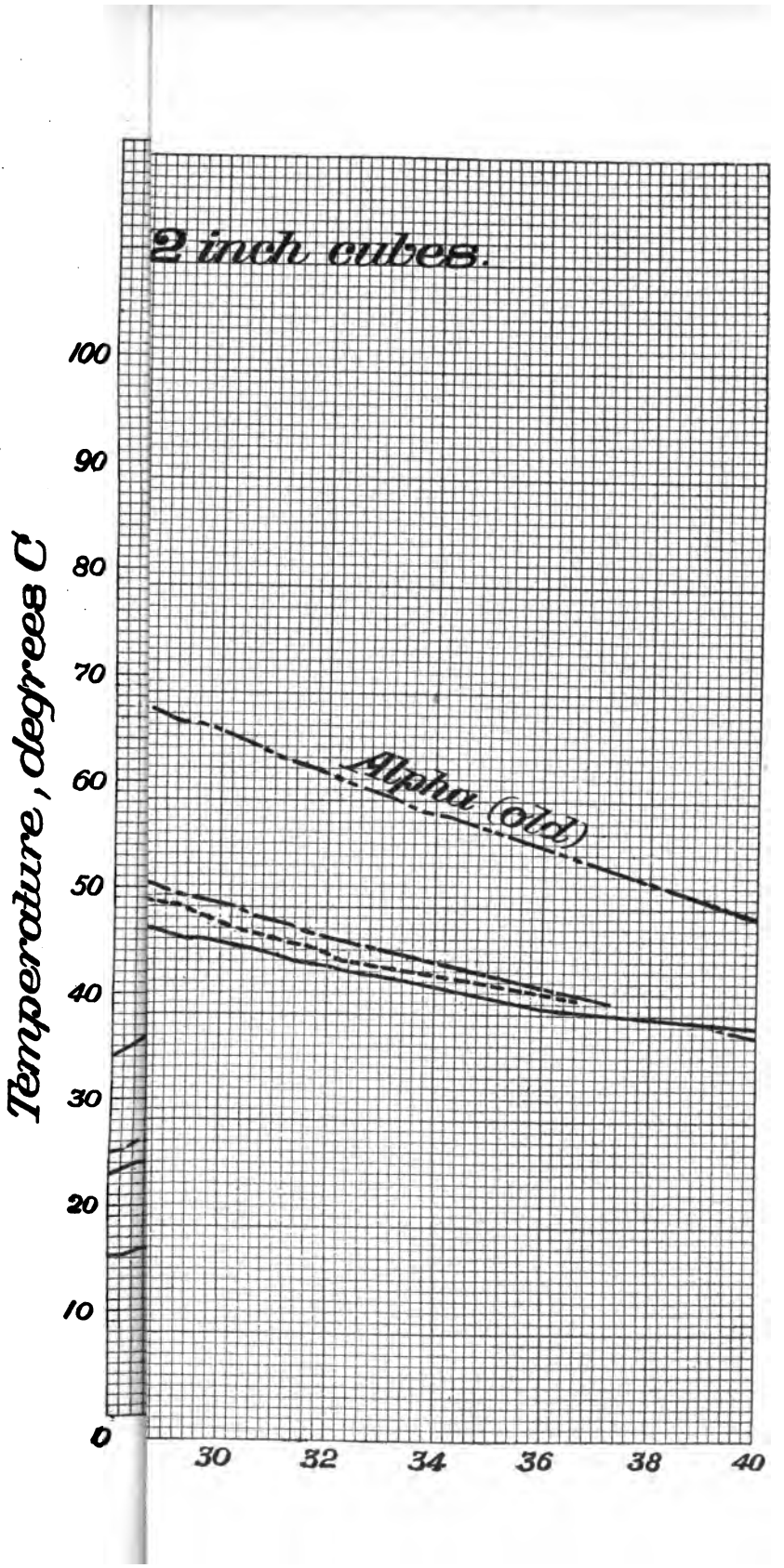
TEMPERATURES ACQUIRED BY PORTLAND CEMENTS WHILE SETTING.

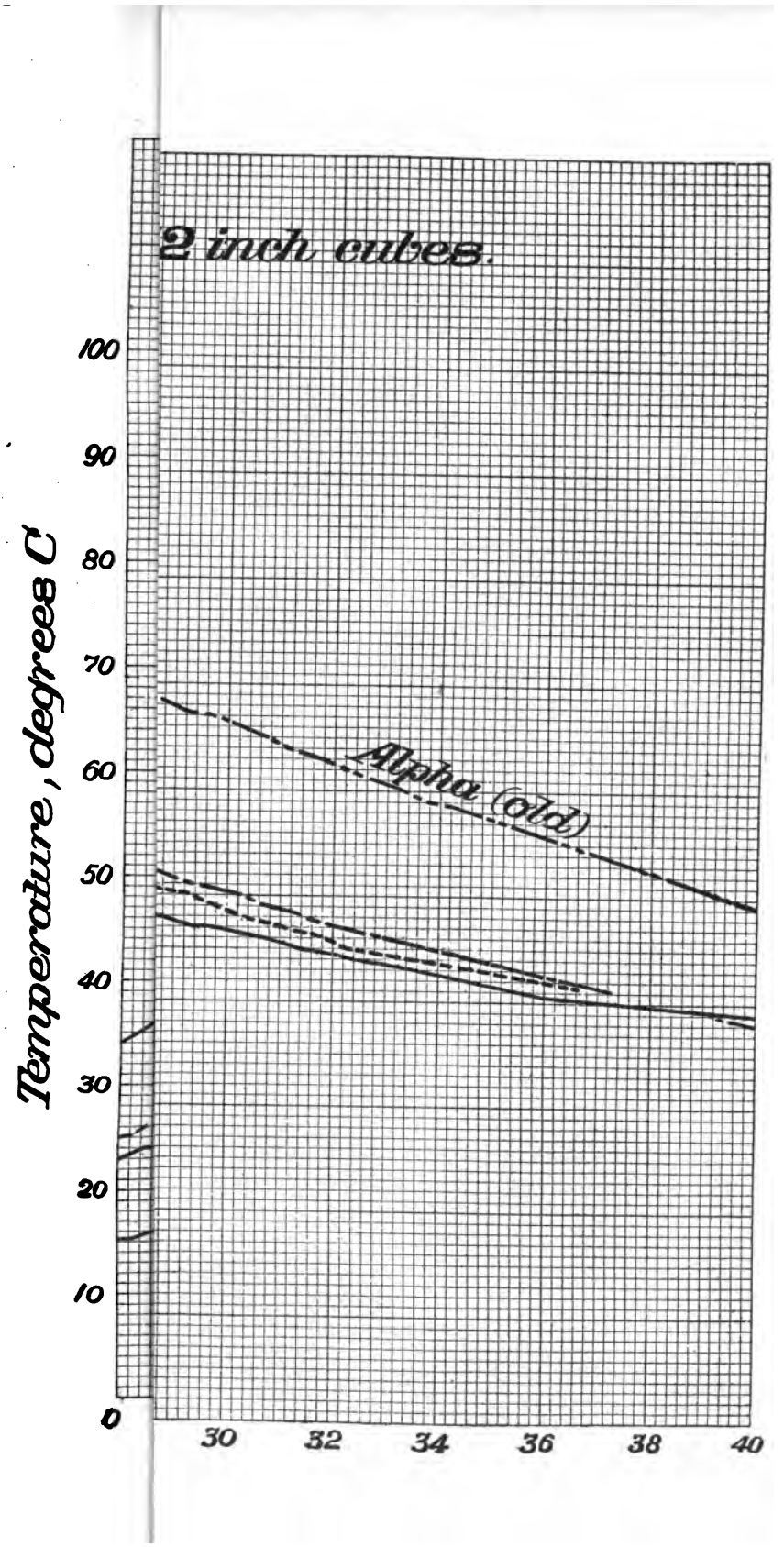
MAXIMUM TEMPERATURES ACQUIRED BY PORTLAND CEMENTS WHILE SETTING.

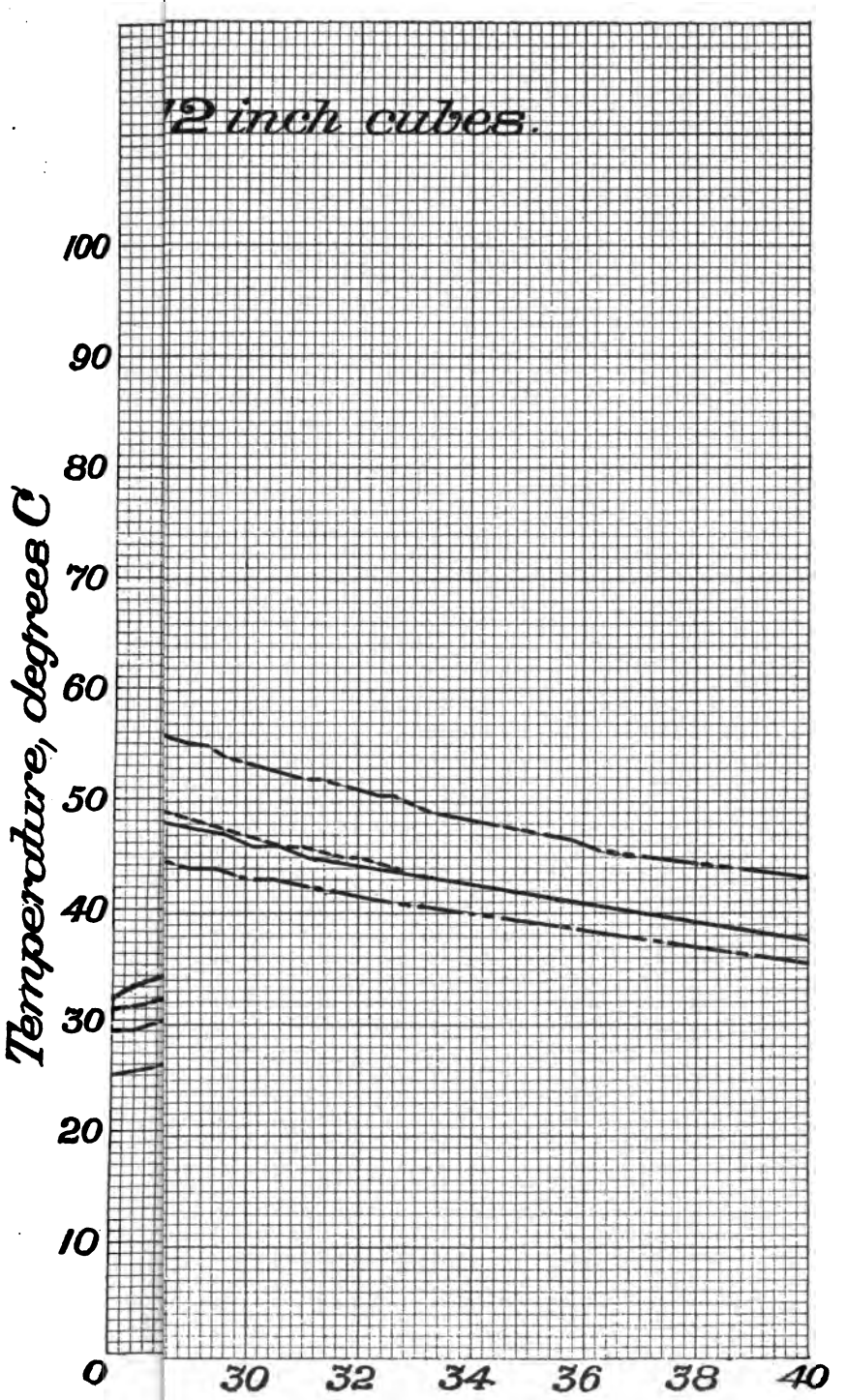
Observations made on 12-inch cubes, temperatures being determined at the center of the cubes. Samples gauged with 25 per cent of water, by weight.

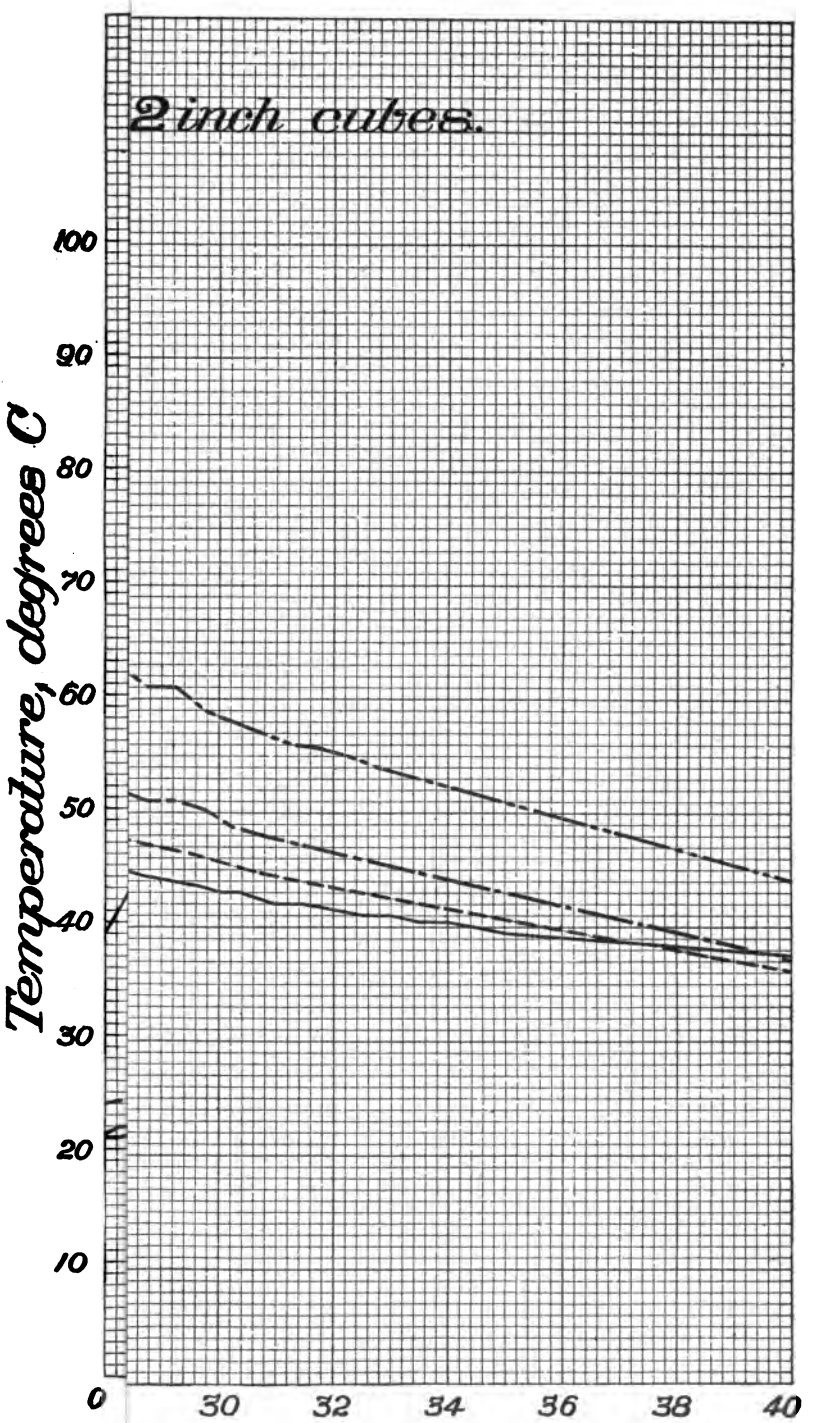
The ages of the cements between time of grinding and of making these observations are shown in the column headed "Age of material." Several of the cements here represented were 6 years old. Earlier observations on the same material may be found in Tests of Metals, etc., 1901. The others were of comparatively recent grinding.

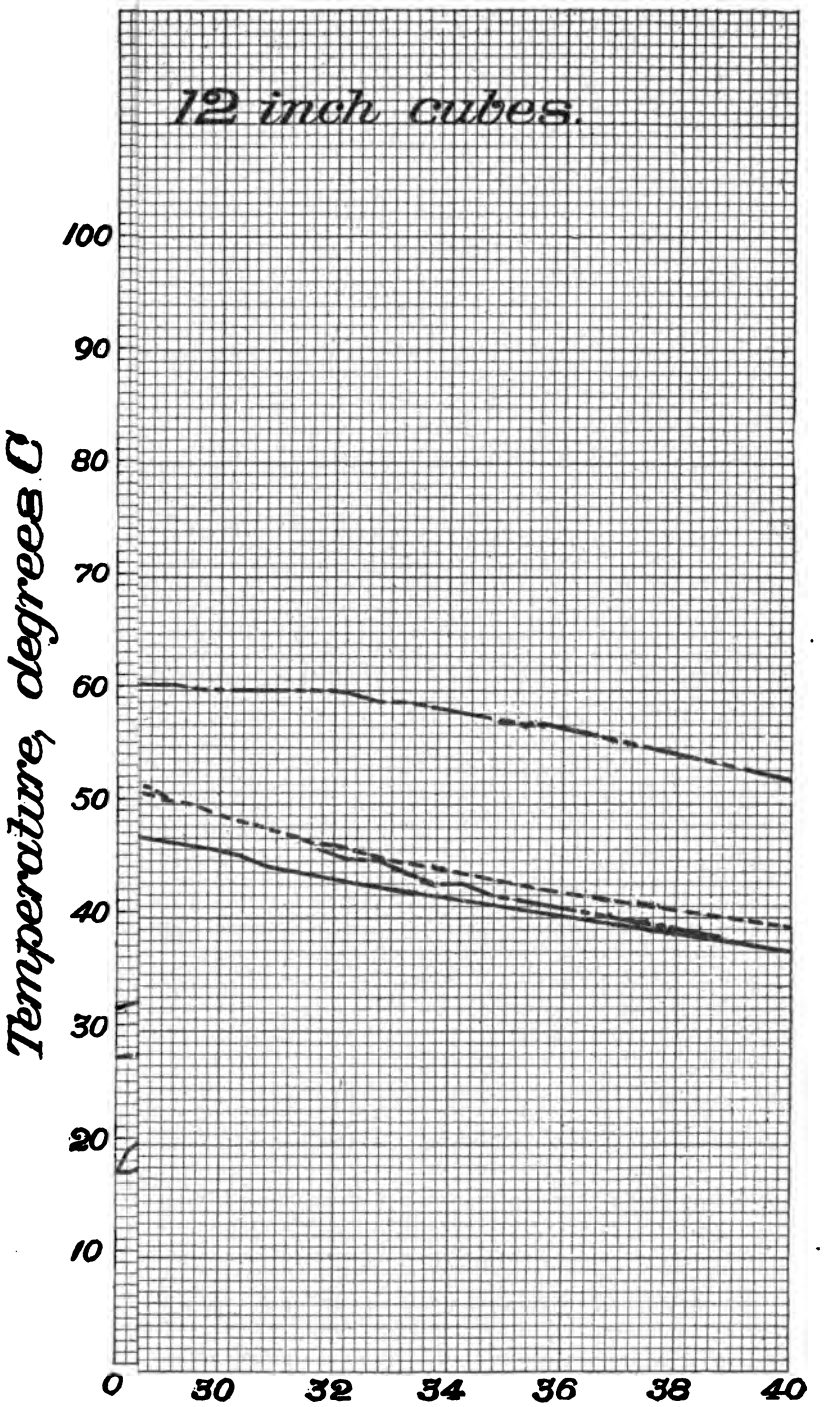
No. of diagram.	Brand.	Age of material.			Maximum temperatures acquired.
		Years.	*Mos.*	*Days.*	°*C.*
1	Alpha (new)				100.25
	Alpha (old)	6			73.0
	Elk				101.0
	Pennsylvania				95.0
2	Edison				85.0
	Owl		1	13	75.5
	Red Diamond		2		92.0
	Wabash				84.5
3	Northampton		1	11	86.0
	Old Dominion		1	24	87.0
	Penn-Allen			26	89.0
	Vulcanite		1	2	94.0
4	Chicago AA				78.0
	Sandusky				95.25
	Wolverine				92.25
5	Giant		2	10	93.0
	Saylor's		1	9	60.5
	Whitehall (new)				99.0
	Whitehall (old)	6			83.0
6	Red Ring				93.5
	Universal		1	20	79.0
	Western States				83.5
7	Atlas (old)	6			62.0
	Peninsular	6			63.5
	Star Portland (old)	6			85.0


2 inch cubes.
Temperature, degrees C
100
90
80
70
60
50
40
30
20
10
0
30
32
34
36
38
40
Alpha (old)


2 inch cubes.
Temperature, degrees C
100
90
80
70
60
50
40
30
20
10
0
30
32
34
36
38
40
Alpha (old)


12 inch cubes.
Temperature, degrees C
100
90
80
70
60
50
40
30
20
10
0
30
32
34
36
38
40


2 inch cubes.
Temperature, degrees C
100
90
80
70
60
50
40
30
20
10
0
30
32
34
36
38
40


12 inch cubes.
Temperature, degrees C
100
90
80
70
60
50
40
30
20
10
0
30
32
34
36
38
40

12 inch cubes.
Temperature, degrees C
Western States
Red Ring
30
32
34
36
38
40

CEMENT, MISCELLANEOUS.

CUBES WHICH SET IN AIR FIVE YEARS OR MORE—SOME AT ORDINARY ATMOSPHERIC TEMPERATURE, OTHERS AT DIFFERENT TEMPERATURES, ATMOSPHERIC AND ZERO FAHR.

CEMENT.

MATERIAL FOR LONG-TIME TESTS.

COMPRESSION TESTS OF 4-INCH CUBES OF DIFFERENT BRANDS OF NEAT CEMENT.

For earlier tests of this series see Reports of 1902, page 369, and 1904, page 341.

Brand and marks.	Composition.		Age, set in air.		Dimensions.			Sectional area.	First crack.	Compressive strength.			Remarks.
	Cement.	Water.			Height.	Compressed surface.				Total.	Per square inch.	Mean.	
		Per cent.	*Yrs.*	*Mos.*	*Inches.*	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	
Star, with plaster, Aug. 26, 1901	Neat	24.6	5	8	3.95	4.04	4.10	16.56	91,000	123,900	7,480	.....	
					3.96	4.02	4.04	16.24	102,000	109,000	6,710	.....	
					4.01	3.95	4.02	15.88	113,200	113,200	7,130	.....	
					4.02	3.97	4.08	16.20	51,000	141,000	8,700	.....	
					3.95	4.09	4.07	16.65	120,000	139,800	8,400	7,680	
Star, without plaster, Aug. 26, 1901	Neat	25.4	5	8	4.01	4.01	4.04	16.20	25,800	145,200	8,960	.....	
					4.04	4.02	4.06	16.32	85,000	114,600	7,020	7,990	
Cathedral, Sept. 21, 1901	Neat	26.7	5	7	3.93	4.03	4.03	16.24	102,000	102,000	6,280	6,280	
Silica, Aug. 27, 1901	Neat	29.1	5	7	3.97	4.02	4.02	16.16	60,400	60,400	3,740	.....	
					4.00	4.09	4.05	16.56	61,400	61,400	3,710	.....	
					3.96	4.01	4.03	16.16	46,000	51,100	3,160	.....	
					3.96	4.02	4.04	16.24	48,500	59,800	3,680	.....	
					4.00	4.05	4.04	16.36	73,000	73,000	4,460	3,750	
Austin, Sept. 20, 1901	Neat	35.4	5	6	3.96	4.06	4.05	16.44	33,400	33,400	2,030	.....	Cracked before testing.
					3.96	4.06	4.05	16.44	34,000	46,800	2,850	2,440	Do.
Bonneville Improved, Sept. 17, 1901	Neat	38.7	5	6	3.97	3.99	4.10	16.36	4,000	34,200	2,090	.....	Do.
					3.97	4.03	4.10	16.52	12,000	26,500	1,600	.....	Do.
					3.98	4.05	4.11	16.65	22,000	41,200	2,470	2,050	Broken in 2 pieces before testing.
Hoffman, Sept. 18, 1901	Neat	36.2	5	6	4.02	3.99	4.02	16.04	59,500	59,500	3,710	3,710	Cracked before testing.
Mankato, Sept. 21, 1901	Neat	41.2	5	6	3.98	4.01	4.00	16.04	34,000	39,400	2,460	.....	Do.
					3.97	3.98	4.00	15.92	30,600	30,600	1,920	.....	Do.
					4.03	3.97	4.08	16.20	35,300	35,300	2,180	.....	Do.
					3.96	4.06	4.01	16.28	35,000	37,900	2,330	2,220	Do.

COMPRESSION TESTS OF 4-INCH CUBES OF DIFFERENT BRANDS OF NEAT CEMENT—Continued.

Brand and marks.	Composition.		Age, set in air.		Dimensions.			Sectional area.	First crack.	Compressive strength.			Remarks.
	Cement.	Water.			Height.	Compressed surface.				Total.	Per square inch.	Mean.	
		Per cent.	*Yrs.*	*Mos.*	*Inches.*	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	
Newark & Rosendale, Aug. 24, 1901.....	Neat....	42.8	5	7	3.97	4.03	4.07	16.40	24,000	29,800	1,820	.....	Cracked before testing.
					4.07	3.96	4.05	16.04	32,609	32,600	2,030	.....	Do.
					3.99	4.05	4.06	16.44	34,800	34,800	2,120	.....	
					4.00	4.05	4.01	16.24	36,500	36,500	2,250	2,055	Do.
Potomac, Aug. 26, 1901.....	Neat....	50.0	5	7	4.01	3.99	4.02	16.04	8,000	21,100	1,320	.....	Do.
					3.98	4.01	3.97	15.92	8,900	22,100	1,390	.....	Do.
					4.01	4.00	3.98	15.92	8,500	16,700	1,050	.....	Do.
					3.97	4.03	3.97	16.00	11,000	20,700	1,290	.....	Do.
					3.95	4.05	4.00	16.20	15,200	23,000	1,420	1,290	Do.

4-INCH CUBES OF NATURAL CEMENT, SET IN AIR 6 YEARS.

CRACKS DEVELOPED DURING SEASONING.

Cements which Set in Air at Different Temperatures.

COMPRESSION TESTS OF SPECIMENS WHICH SET IN AIR AT 0° F., PRECEDED AND FOLLOWED BY DIFFERENT INTERVALS AT 70° F.

See Reports of 1902, page 389, and 1903, page 505, for earlier tests of this series.

Marks.	Brand of cement.	Composition.			Time of setting in air at temperatures of—			Dimensions.			Sectional area.	Compressive strength.			Remarks.
		Cement.	Sand.	Water.	70° F.	0° F.	70° F.	Height.	Compressed surface.			Total.	Per square inch.	Mean.	
				Per cent.	*Days.*	*Years.*	*Days.*	*Inches.*	*Inches.*	*Inches.*	*Sq. in.*	*Lbs.*	*Lbs.*	*Lbs.*	
Alp. Mar. 8	Alpha	Neat.		23.0	4	5	1	2.03	2.01	2.03	4.06	32,000	7,900		
								2.02	2.00	1.99	3.98	27,500	6,910		
								1.99	1.97	2.00	3.94	31,400	7,970		
								2.01	2.00	2.00	4.00	33,000	8,275		
								2.04	2.00	2.01	4.02	30,100	7,490	7,770	
Alp. Mar. 8	Alpha	Neat.		23.0	4	5	41	2.02	1.99	1.99	3.98	37,000	9,270		
								2.02	1.99	1.98	3.94	35,100	8,910		
								1.96	2.04	1.99	4.06	32,400	7,980		
								2.04	2.02	1.99	4.02	36,100	8,980		
								2.04	2.00	2.00	4.00	37,500	9,375	8,700	
Alp. Apr. 26	Alpha	Neat.		23.0	7	5	1	2.05	2.01	2.00	4.02	32,900	8,180		
								2.01	2.05	1.95	4.00	24,400	6,100		
								2.01	2.04	2.04	4.16	25,500	6,370		
								2.05	2.00	2.00	4.00	28,900	7,220		
								2.00	2.10	2.00	4.20	30,000	8,710	7,300	
Alp. Apr. 26	Alpha	Neat.		23.0	7	5	41	2.01	2.00	1.99	3.98	27,100	6,810		
								2.01	2.02	1.98	4.02	28,100	6,970		
								2.02	2.01	2.00	4.02	24,100	8,000		
								2.00	2.00	1.97	3.94	25,400	6,710		
								2.00	2.02	1.99	4.02	27,300	8,290	7,000	
Atl. Feb. 27	Atlas	Neat.		24.0	1	5	1	1.99	1.99	2.02	4.04	18,700	4,600		Less uniform before test.
								2.04	1.95	2.02	3.94	18,700	4,750		
								1.99	1.97	2.00	3.94	16,300	3,700		Bad.
								1.99	1.99	2.02	4.02	16,100	4,000		
								2.00	2.00	2.01	4.02	15,700	3,900	4,100	

COMPRESSION TESTS OF SPECIMENS WHICH SET IN AIR AT 0° F., PRECEDED AND FOLLOWED BY DIFFERENT INTERVALS AT 70° F.—Continued.

Marks.	Brand of cement.	Composition.			Time of setting in air at temperatures of—			Dimensions.			Sectional area.	Compressive strength.			Remarks.
		Cement.	Sand.	Water.	70° F.	0° F.	70° F.	Height.	Compressed surface.			Total.	Per square inch.	Mean.	
				Per cent.	*Days.*	*Years.*	*Days.*	*Inches.*	*Inches.*	*Inches.*	*Sq. in.*	*Lbs.*	*Lbs.*	*Lbs.*	
Atl. Feb. 27	Atlas	Neat.		24.0	1	5	40	2.06	2.00	2.03	4.06	28,500	7,020		
								1.98	2.00	2.01	4.02	32,500	8,080		
								2.02	2.00	2.04	4.08	20,200	4,950		
								2.02	2.01	2.01	4.04	30,100	7,450		Cube cracked before testing.
								2.00	2.00	2.01	4.02	25,800	6,420	6,780	Do.
Atl. Mar. 13	Atlas	Neat.		23.5	4	5	1	2.04	2.00	2.03	4.06	27,500	6,770		
								2.00	2.11	2.03	4.28	21,700	5,070		
								2.00	2.04	2.02	4.12	19,000	4,610		
								2.00	2.01	2.04	4.10	22,600	5,510		
								1.98	2.00	2.04	4.08	24,400	5,980	5,590	
Atl. Mar. 13	Atlas	Neat.		23.5	4	5	40	1.97	2.01	2.03	4.08	24,200	5,930		
								1.96	1.98	2.03	4.02	32,000	7,960		
								1.98	2.03	2.04	4.14	36,400	8,790		
								1.99	2.00	2.02	4.04	33,500	8,290		
								2.00	2.01	2.04	4.10	36,500	8,900	7,970	
Atl. Mar. 12	Atlas	Neat.		24.0	7	5	1	2.05	1.94	2.01	3.90	25,300	6,490		
								2.04	2.00	2.02	4.04	30,400	7,520		
								1.99	2.04	2.06	4.20	29,200	6,950		
								1.99	2.03	2.03	4.12	21,300	5,170		
								1.98	2.00	2.01	4.02	28,500	7,090	6,640	
Atl. Mar. 12	Atlas	Neat.		24.0	7	5	40	2.03	2.01	2.03	4.08	32,300	7,920		
								1.97	1.98	2.06	4.08	28,400	6,960		
								1.97	1.98	2.05	4.06	30,900	7,610		
								1.90	2.01	1.99	4.00	24,900	6,225		
								2.04	1.98	2.02	4.00	33,400	8,350	7,410	
*Mar. 6	Star (with plaster)	Neat.		25.0	4	5	1	2.03	2.00	2.00	4.00	29,600	7,400		
								2.03	2.04	1.93	3.94	25,500	6,470		
								2.00	2.05	1.99	4.08	28,300	6,940		
								2.03	2.00	2.04	4.08	30,600	7,500		
								2.00	2.05	2.00	4.10	27,000	6,590	6,980	

* Mar. 6	Star (with plaster)	Neat.		25.0	4	5	40	2.04	1.93	2.00	3.86	33,100	8,580		
								2.02	2.00	2.00	4.00	39,600	9,900		Do.
								2.00	2.02	1.98	4.00	42,100	10,525		
								2.00	2.02	2.00	4.04	39,700	9,830		Do.
								1.99	2.02	2.01	4.06	32,900	8,100	9,390	
* Mar. 14	Star (with plaster)	Neat.		24.5	7	5	1	2.07	2.01	2.04	4.10	30,800	7,510		
								1.95	2.00	2.06	4.12	24,400	5,920		
								2.00	2.01	2.01	4.04	27,900	6,740		
								2.04	1.99	2.01	4.00	29,100	7,275		
								2.02	2.00	2.01	4.02	24,300	6,040	6,700	
* Mar. 14	Star (with plaster)	Neat.		24.5	7	5	40	2.02	1.99	2.04	4.06	28,200	6,950		Do.
								1.98	2.03	2.01	4.08	38,200	9,360		
								1.98	2.00	2.04	4.08	25,200	6,180		Do.
								1.98	2.03	2.02	4.10	40,700	9,930		
								2.02	2.00	2.02	4.04	40,600	10,050	8,500	
* F. 28	Star (without plaster)	Neat.		30.0	3	5	1	2.04	1.93	2.05	3.96	14,900	3,760		Do.
								2.09	2.00	2.02	4.04	16,600	4,110		
								2.07	1.98	2.02	4.00	18,400	4,600		Do.
								1.98	1.97	2.03	4.00	15,500	3,875		Do.
								2.00	2.00	2.04	4.08	16,500	4,040	4,080	Do.
* F. 28	Star (without plaster)	Neat.		30.0	3	5	40	1.99	2.04	2.02	4.12	18,400	4,470		Do.
								2.00	1.98	2.01	3.98	22,100	5,550		Do.
								1.98	2.00	2.02	4.04	18,200	4,500		Do.
								2.00	1.90	2.03	3.86	16,500	4,270		Do.
								1.99	2.00	2.03	4.06	21,400	5,270	4,810	Do.
Wh. Mar. 10	Whitehall	Neat.		23.5	4	5	1	2.01	2.00	2.02	4.04	27,400	6,780		
								2.00	1.99	2.04	4.06	33,600	8,280		
								2.00	1.98	1.99	3.94	32,300	8,200		
								2.01	2.02	2.03	4.10	32,500	7,930		
								2.00	2.09	2.00	4.18	22,000	5,260	7,290	
Wh. Mar. 10	Whitehall	Neat.		23.5	4	5	41	2.01	2.02	2.03	4.10	39,400	9,610		
								2.00	2.00	2.02	4.04	43,100	10,670		
								2.00	1.99	2.01	4.00	39,500	9,875		
								1.99	2.03	2.04	4.14	42,400	10,240		
								2.00	2.00	2.03	4.06	35,600	8,770	9,830	
Wh. Apr. 30	Whitehall	Neat.		23.5	7	5	1	2.03	2.06	2.00	4.12	28,900	7,010		
								2.01	2.02	1.99	4.02	32,600	8,110		
								2.04	2.00	2.03	4.06	32,700	8,050		
								2.02	2.01	2.03	4.08	33,500	8,210		
								1.94	2.04	2.02	4.12	32,600	7,910	7,860	
Wh. Apr. 30	Whitehall	Neat.		23.5	7	5	41	2.01	1.99	2.02	4.02	29,900	7,440		
								2.04	1.99	2.00	3.98	38,600	9,700		
								2.00	2.04	2.00	4.08	37,100	9,090		
								2.04	1.94	2.00	3.88	29,500	7,600		
								1.99	2.01	2.03	4.08	39,600	9,710	8,710	

COMPRESSION TESTS OF SPECIMENS WHICH SET IN AIR AT 0° F., PRECEDED AND FOLLOWED BY DIFFERENT INTERVALS AT 70° F.—Continued.

Marks.	Brand of cement.	Composition.			Time of setting in air at temperatures of—			Dimensions.			Sectional area.	Compressive strength.			Remarks.
		Cement.	Sand.	Water.	70° F.	0° F.	70° F.	Height.	Compressed surface.			Total.	Per square inch.	Mean.	
				Per cent.	*Days.*	*Years.*	*Days.*	*Inches.*	*Inches.*	*Inches.*	*Sq. in.*	*Lbs.*	*Lbs.*	*Lbs.*	
Aus. Mar. 7	Austin	Neat		34.5	4	5	1	2.02	2.03	2.05	4.16	6,400	1,540	.....	
								2.00	1.99	2.06	4.10	7,490	1,830	.....	
								2.00	2.05	2.06	4.22	7,140	1,690	.....	
								2.05	2.03	2.03	4.12	7,760	1,880	.....	
								2.00	2.02	2.05	4.14	6,980	1,690	1,730	
Aus. Mar. 7	Austin	Neat		34.5	4	5	40	2.03	2.00	2.03	4.06	8,780	2,160	.....	
								2.00	1.99	2.03	4.04	9,700	2,400	.....	
								2.04	2.02	2.00	4.04	10,500	2,600	.....	
								2.04	1.94	2.02	3.92	12,300	3,140	.....	
								2.00	2.04	2.05	4.18	10,100	2,420	2,540	
Aus. Mar. 15	Austin	Neat		35.0	7	5	1	2.00	2.03	2.05	4.16	6,040	1,450	.....	
								2.01	2.01	2.05	4.12	8,900	2,160	.....	
								1.99	1.97	2.06	4.06	7,520	1,850	.....	
								2.01	2.02	2.05	4.14	6,200	1,500	.....	
								1.95	2.05	2.08	4.26	6,500	1,530	1,700	
Aus. Mar. 15	Austin	Neat		35.0	7	5	40	1.98	2.08	1.98	4.12	8,100	1,970	.....	
								1.99	2.03	2.04	4.14	9,800	2,370	.....	
								1.98	2.00	2.06	4.12	9,950	2,420	.....	
								2.00	1.98	2.06	4.08	11,800	2,890	.....	
								2.00	1.98	2.04	4.04	10,800	2,670	2,460	
N. & R. Mar. 11	Newark & Rosendale.	Neat		38.1	4	5	1	2.00	2.01	2.04	4.10	7,300	1,780	.....	
								2.00	2.04	2.06	4.20	8,300	1,980	.....	
								2.00	2.05	2.03	4.16	6,000	1,440	.....	
								2.00	2.01	2.07	4.16	7,560	1,820	.....	
								2.00	2.06	2.02	4.16	6,250	1,500	1,700	
N. & R. Mar. 11	Newark & Rosendale.	Neat		38.1	4	5	40	1.98	1.99	2.04	4.06	8,700	2,140	.....	
								2.02	1.99	2.04	4.06	9,200	2,270	.....	
								1.98	1.99	2.04	4.06	8,900	2,190	.....	
								2.01	2.00	2.06	4.12	9,700	2,350	.....	
								1.98	2.01	2.04	4.10	9,800	2,390	2,270	

N. & R. May 1..	Newark & Rosendale.	Neat....	.....	38.1	7	5	1	2.01	2.03	2.06	4.18	8,060	1,930	.....	
								2.06	1.99	2.04	4.06	5,500	1,350	.....	
								2.04	2.02	2.01	4.06	6,840	1,680	.....	
								2.04	1.95	2.04	3.98	6,100	1,530	.....	
								1.99	2.06	2.03	4.18	7,100	1,740	1,650	
N. & R. May 1..	Newark & Rosendale.	Neat....	.....	38.1	7	5	40	1.97	2.00	2.01	4.02	9,200	2,290	.....	
								2.02	1.92	2.05	3.94	8,100	2,060	.....	
								2.01	2.00	2.06	4.12	9,700	2,350	.....	
								2.02	2.03	2.06	4.18	11,500	2,750	.....	
								2.00	2.03	2.03	4.12	11,200	2,720	2,430	
Alp. Feb. 20.....	Alpha.....	Neat....	.....	25.0	1	5	1	1.95	2.00	2.00	4.00	22,400	5,600	.....	
								2.02	2.00	1.98	3.96	27,500	6,940	.....	
								2.02	1.99	2.00	3.98	18,700	4,700	.....	
								1.97	2.00	2.01	4.02	29,300	7,290	.....	
								1.99	1.97	2.00	3.94	27,900	7,080	6,320	
Alp. Feb. 20.....	Alpha.....	Neat....	.....	25.0	1	5	36	1.98	2.06	2.02	4.16	36,600	8,800	.....	
								2.00	1.99	2.00	3.98	36,300	9,120	.....	
								1.98	2.00	2.00	4.00	28,900	7,225	.....	
								2.01	2.06	2.00	4.12	30,500	7,400	.....	
								2.00	2.01	1.99	4.00	31,900	7,975	8,100	
* Feb. 14.....	Star (with plaster)...	Neat....	.....	27.0	1	5	1	2.00	1.98	2.00	3.96	26,700	6,740	.....	
								1.99	2.04	2.00	4.08	30,600	7,500	.....	
								2.02	2.05	2.04	4.18	25,500	6,100	.....	
								2.00	2.01	2.03	4.08	26,300	6,450	.....	
								2.08	2.05	1.98	4.06	26,400	6,500	6,660	
* Feb. 14.....	Star (with plaster)...	Neat....	.....	27.0	1	5	36	2.00	1.97	2.02	3.98	33,500	8,420	.....	
								2.03	1.99	2.01	4.00	35,400	8,850	.....	
								2.03	1.99	2.00	3.98	30,700	7,710	.....	
								2.06	2.02	1.96	3.96	30,600	7,730	8,180	
* Feb. 15.....	Star (with plaster)...	Neat....	.....	25.0	2	5	1	2.03	2.04	2.00	4.08	23,800	5,830	.....	
								2.02	2.03	2.01	4.08	27,900	6,840	.....	
								2.00	2.09	2.00	4.18	28,600	6,840	.....	
								2.00	2.05	2.00	4.10	28,900	7,050	.....	
								2.00	2.04	2.02	4.12	32,400	7,860	6,880	
* Feb. 15.....	Star (with plaster)...	Neat....	.....	25.0	2	5	36	1.99	2.04	2.01	4.10	30,800	7,510	.....	
								2.01	2.00	1.99	3.98	36,500	9,170	.....	
								2.00	2.10	1.96	4.12	35,700	8,670	.....	
								2.02	2.05	2.00	4.10	32,500	7,930	.....	
								2.03	2.01	2.02	4.06	40,100	9,880	8,630	
* Feb. 19.....	Star (with plaster)...	Neat....	.....	24.0	0	5	1	2.04	2.02	2.02	4.08	12,400	3,040	.....	These cubes were frozen immediately after manufacture.
								2.06	1.96	1.99	3.90	11,200	2,870	.....	
								2.06	2.06	2.01	4.14	16,100	3,890	.....	
								2.09	2.04	2.02	4.12	12,600	3,060	.....	
								2.02	2.03	2.00	4.06	13,800	3,400	3,250	

COMPRESSION TESTS OF SPECIMENS WHICH SET IN AIR AT 0° F., PRECEDED AND FOLLOWED BY DIFFERENT INTERVALS AT 70° F.—Continued.

Marks.	Brand of cement.	Composition.			Time of setting in air at temperatures of—			Dimensions.			Sectional area.	Compressive strength.			Remarks.
		Cement.	Sand.	Water.	70° F.	0° F.	70° F.	Height.	Compressed surface.			Total.	Per square inch.	Mean.	
				Per cent.	*Days.*	*Years.*	*Days.*	*Inches.*	*Inches.*	*Inches.*	*Sq. in.*	*Lbs.*	*Lbs.*	*Lbs.*	
* Feb. 19	Star (with plaster)	Neat		24.0	0	5	36	2.02	2.00	2.04	4.08	18,100	4,440		Immediately frozen. These cubes fractured with dull noises; not brittle as in the case of those of initial period in air before freezing.
								2.04	2.03	2.02	4.10	18,900	4,610		
								1.98	2.00	1.99	3.98	18,500	4,650		
								2.06	2.03	1.99	4.04	15,200	3,760		
								2.03	2.04	2.03	4.14	15,200	3,670	4,230	
* Feb. 17	Star (without plaster)	Neat		29.5	1	5	1	1.98	1.99	2.01	4.00	17,500	4,375		
								1.96	2.01	2.00	4.02	16,700	4,150		
								2.02	1.98	2.00	3.96	14,200	3,590		
								1.98	2.02	2.01	4.06	13,300	3,280		
								2.06	2.00	2.00	4.00	10,300	2,575	3,590	
* Feb. 17	Star (without plaster)	Neat		29.5	1	5	36	1.99	2.04	2.02	4.12	18,800	4,560		
								2.05	2.00	1.99	3.98	24,100	6,060		
								1.99	2.00	2.00	4.00	21,700	5,425		
								2.01	2.03	2.01	4.08	22,400	5,490		
								1.99	2.01	2.02	4.06	24,200	5,960	5,500	
Wh. Feb. 24	Whitehall	Neat		23.5	1	5	1	2.08	2.02	2.07	4.18	30,500	7,300		
								2.00	2.10	2.03	4.26	22,400	5,260		
								2.04	2.03	2.00	4.06	25,800	6,350		
								2.04	2.02	2.00	4.04	23,400	5,790		
								2.00	2.02	2.03	4.10	28,700	7,000	6,340	
Wh. Feb. 24	Whitehall	Neat		23.5	1	5	36	2.00	1.98	2.05	4.06	33,100	8,150		
								2.01	2.01	2.00	4.02	35,800	8,910		
								2.00	2.05	2.01	4.12	31,100	7,550		
								2.02	2.01	2.03	4.08	31,500	7,720	8,082	
Aus. Feb. 18	Austin	Neat		37.5	1	5	1	1.97	2.01	2.05	4.12	5,600	1,360		
								2.02	2.00	2.04	4.08	6,300	1,540		
								2.04	1.94	2.04	3.96	5,400	1,360		
								2.05	2.07	2.06	4.26	6,300	1,480		
								2.03	2.01	2.03	4.08	5,500	1,350	1,420	

Aus. Feb. 18....	Austin.....	Neat....	.....	37.5	1	5	36	2.02	2.04	2.03	4.14	10,400	2,510	.....	
								2.00	1.99	2.04	4.06	9,900	2,440	.....	
								2.00	2.06	2.06	4.24	7,500	1,770	.....	
								2.05	2.00	2.03	4.06	8,300	2,040	.....	
								2.00	2.02	2.06	4.16	9,500	2,280	2,210	
Aus. Feb. 19....	Austin.....	Neat....	.....	35.0	0	5	1	2.00	2.01	2.05	4.12	6,400	1,550	.....	These cubes were frozen immediately after manufacture.
								2.06	2.00	2.01	4.02	7,100	1,770	.....	
								2.00	2.05	2.03	4.16	6,100	1,470	.....	
								2.00	2.04	2.06	4.20	6,700	1,600	.....	
								1.95	2.00	2.05	4.10	5,500	1,340	1,550	
Aus. Feb. 19....	Austin.....	Neat....	.....	35.0	0	5	36	2.00	2.02	2.04	4.12	10,600	2,570	.....	
								1.99	2.05	2.05	4.20	10,300	2,450	.....	Do.
								2.00	2.04	2.05	4.18	10,300	2,460	.....	
								2.00	2.00	2.06	4.12	9,200	2,230	.....	
								2.02	2.02	2.04	4.12	11,000	2,670	2,480	
N. & R. Feb. 26.	Newark & Rosendale.	Neat....	.....	38.0	1	5	1	2.04	2.00	2.05	4.10	4,300	1,050	.....	
								1.93	2.03	2.04	4.14	3,500	850	.....	
								1.98	2.00	2.04	4.08	4,200	1,030	.....	
								2.03	2.01	2.07	4.16	4,400	1,060	.....	
								2.00	2.01	2.06	4.14	3,500	850	970	
N. & R. Feb. 26.	Newark & Rosendale.	Neat....	.....	38.0	1	5	36	2.03	2.03	2.04	4.14	5,400	1,300	.....	
								2.01	2.02	2.02	4.08	6,100	1,500	.....	
								2.05	1.94	2.04	3.96	5,200	1,310	.....	
								2.00	2.05	2.05	4.20	6,300	1,500	1,400	

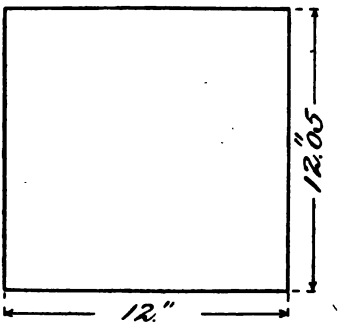
CONCRETE AND MORTAR COLUMNS.

PLAIN AND REËNFORCED WITH LONGITUDINAL BARS, WIRE HELIXES AND HOOPS, THE LATTER WITH AND WITHOUT LONGITUDINAL BARS.

REËNFORCING HOOPS FURNISHED BY MR. R. A. CUMMINGS, PITTSBURG, PA.; WIRE HELIXES AND OTHER MATERIAL FOR COLUMNS OF THE HENNEBIQUE TYPE FURNISHED BY MR. R. BAFFREY, NEW YORK.

No. 1809.

1 : 0 : 1 Mixture.
Plain column, without reënforcing metal.



Composition, by volume: Saylor's Portland cement, 1; sand, 0; trap rock (crusher dust), 1. Water, 32.4 per cent of cement, by weight.
Age, set in air, 8 months 19 days.
Weight of column, total 1,086 pounds.
Weight of concrete, 1,086 pounds = 135.1 pounds per cubic foot.
Height of column, 96.04 inches.
Sectional area, $12'' \times 12''.05 = 144.60$ square inches.
Gauged length, 50".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
14,460	100	0.	0.	Initial load. Loaded with 10,000 pounds before testing.
21,690	150	.0006	0.	
28,920	200	.0014	0.	
36,150	250	.0024	0.	
43,380	300	.0030	0.	
50,610	350	.0040	0.	
57,840	400	.0050	.0005	
65,070	450	.0064	.0005	
72,300	500	.0075	.0006	
79,530	550	.0086	.0006	
86,760	600	.0095	.0008	E (100–600) = 2,874,000 pounds per square inch.
.....	600	0095	.0008	
93,990	650	.0105	.....	
101,220	700	.0116	.....	
108,450	750	.0126	.....	
115,680	800	.0137	.....	
122,910	850	.0148	.....	
130,140	900	.0159	.....	
137,370	950	.0170	.....	
144,600	1,000	.0180	.0015	E (600–1,000) = 2,564,000 pounds per square inch.
.....	600	.0104	.0015	
.....	600	.0105	.0015	
159,060	1,100	.0200	.....	
173,520	1,200	.0225	.....	
187,980	1,300	.0249	.....	
202,440	1,400	.0272	.....	
216,900	1,500	.0298	.0025	E (1,000–1,500) = 2,315,000 pounds per square inch.

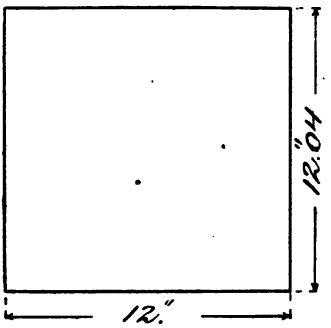
No. 1809—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
.....	600	.0119	.0025	
.....	600	.0118	.0025	
.....	100	.....	0.	After resting under initial load 16 hours.
.....	600	.0095	.0005	
.....	1,500	.0280	.0010	
.....	600	.0103	.0009	
231,360	1,600	.0307	.....	
245,820	1,700	.0335	.....	
260,280	1,800	.0360	.....	
274,740	1,900	.0386	.....	
289,200	2,000	.0417	.0035	E (1,500-2,000)=2,294,000 pounds per square inch.
.....	600	.0130	.0033	
.....	600	.0130	.0032	
303,660	2,100	.0448	.....	
318,120	2,200	.0477	.....	
332,580	2,300	.0509	.....	
347,040	2,400	.0540	.....	
361,500	2,500	.0573	.0071	E (2,000-2,500)=2,083,000 pounds per square inch.
.....	600	.0171	.0068	
.....	600	.0169	.0066	
514,000	3,555	.....	.....	Ultimate strength.

Column failed in the upper half. A wedge-shaped fragment developed.

No. 1799.

1 : 0 : 2 Mixture.
Plain column, without reënforcing metal.



Composition, by volume: Saylor's Portland cement, 1; sand, 0; trap rock (crusher dust), 2. Water, 36 per cent of cement, by weight.
Age, set in air, 7 months 26 days.
Weight of column, total, 1,103 pounds.
Weight of concrete, 1,103 pounds = 137.2 pounds per cubic foot.
Height of column, 96.20 inches.
Sectional area, 12" × 12".04 = 144.48 square inches.
Gauged length, 50".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
14,448	100	0.	0.	Initial load. Loaded with 13,000 pounds before testing.
21,672	150	.0006	0.	
28,896	200	.0015	0.	
36,120	250	.0023	0.	
43,344	300	.0032	0.	
50,568	350	.0041	0.	
57,792	400	.0051	0.	
65,016	450	.0061	.0003	
72,240	500	.0071	.0004	
79,464	550	.0081	.0005	
86,688	600	.0091	.0006	E (100–600) = 2,941,000 pounds per square inch.
.....	600	.0092	.0006	
93,912	650	.0104	.....	
101,136	700	.0114	.....	
108,360	750	.0125	.....	
115,584	800	.0136	.....	
122,808	850	.0148	.....	
130,032	900	.0160	.....	
137,256	950	.0172	.....	
144,480	1,000	.0186	.0018	E (600–1,000) = 2,410,000 pounds per square inch.
.....	600	.0108	.0018	
.....	600	.0108	.0018	
158,928	1,100	.0210	.....	
173,376	1,200	.0239	.....	
187,824	1,300	.0264	.....	
202,272	1,400	.0289	.....	
216,720	1,500	.0317	.0040	E (1,000–1,500) = 2,294,000 pounds per square inch.

No. 1799—Continued.

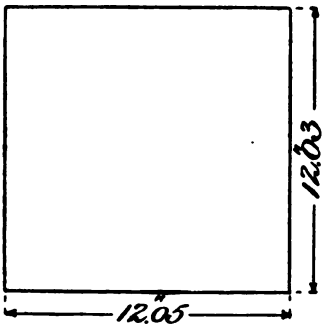
Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
.....	600	.0134	.0040	
.....	600	.0134	.0039	
231,168	1,600	.0329	.....	
245,616	1,700	.0360	.....	
260,064	1,800	.0391	.....	
274,512	1,900	.0429	.....	
288,960	2,000	.0468	.0066	E (1,500–2,000) = 2,000,000 pounds per square inch.
.....	600	.0169	.0066	
.....	600	.0167	.0066	
303,408	2,100	.0515	.....	
317,856	2,200	.0557	.0098	
.....	600	.0204	.0093	
.....	600	.0199	.0091	
.....	200	.0110	.....	
.....	400	.0154	.....	
.....	600	.0198	.....	
.....	800	.0228	.....	
.....	1,000	.0289	.....	
.....	800	.0253	.....	
.....	600	.0211	.....	
.....	400	.0166	.....	
.....	200	.0118	.0095	
408,000	2,824	.....	.....	Ultimate strength.

Column failed along the middle of its height. Opened long oblique and longitudinal cracks.

No. 1794.

1 : 0 : 3 Mixture.

Plain column, without reënforcing metal.



Composition, by volume: Saylor's Portland cement, 1; sand, 0; trap rock (crusher dust), 3. Water, 45 per cent of cement, by weight.

Age, set in air, 7 months 23 days.

Weight of column, total, 1,089 pounds.

Weight of concrete, 1,089 pounds = 134.9 pounds per cubic foot.

Height of column, 96.20 inches.

Sectional area, 12″.03 × 12″.05 = 144.96 square inches.

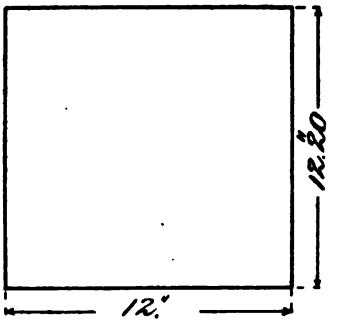
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
14,496	100	0.	0.	Initial load. Loaded with 11,000 pounds before testing.
21,744	150	.0009	0.	
28,992	200	.0020	0.	
36,240	250	.0030	.0002	
43,488	300	.0041	.0003	
50,736	350	.0053	.0004	
57,984	400	.0064	.0006	
65,232	450	.0077	.0008	
72,480	500	.0088	.0009	
79,728	550	.0100	.0010	
86,976	600	.0111	.0013	E (100–600) = 2,551,000 pounds per square inch.
.....	600	.0114	.0014	
94,224	650	.0126	.....	
101,472	700	.0139	.....	
108,720	750	.0153	.....	
115,968	800	.0167	.....	
123,216	850	.0183	.....	
130,464	900	.0197	.....	
137,712	950	.0213	.....	
144,960	1,000	.0230	.0034	E (600–1,000) = 2,041,000 pounds per square inch.
.....	600	.0139	.0034	
.....	600	.0138	.0034	
159,456	1,100	.0261	.....	
173,952	1,200	.0290	.....	
188,448	1,300	.0327	.....	
202,944	1,400	.0361	.....	
217,440	1,500	.0398	.0071	E (1,000–1,500) = 1,906,000 pounds per square inch.
.....	600	.0185	.0071	
.....	600	.0187	.0071	
231,936	1,600	.0452	.....	
246,432	1,700	.0506	.....	
260,928	1,800	.0564	.....	
275,424	1,900	.0629	.....	
281,000	1,938	.....	.....	Ultimate strength.

Column failed in the upper half, opening long, oblique cracks.

No. 1798.

1 : 0 : 4 Mixture.
Plain column, without reënforcing metal.



Composition, by volume: Saylor's Portland cement, 1; sand, 0; trap rock (crusher dust), 4. Water, 54 per cent of cement, by weight.
Age, set in air, 7 months 25 days.
Weight of column, total, 1,086 pounds.
Weight of concrete, 1,086 pounds = 133.3 pounds per cubic foot.
Height of column, 96.20 inches.
Sectional area, $12'' \times 12''.20 = 146.4$ square inches.
Gauged length, 50".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
14,640	100	0.	0.	Initial load. Loaded with 13,000 pounds before testing.
21,960	150	.0013	0.	
29,280	200	.0029	.0004	
36,600	250	.0046	.0008	
43,920	300	.0063	.0012	
51,240	350	.0082	.0016	
58,560	400	.0100	.0023	
65,880	450	.0125	.0029	
73,200	500	.0138	.0036	
80,520	550	.0171	.0045	
87,840	600	.0198	.0052	(100–600) = 1,712,000 pounds per square inch.
.....	600	.0204	.0057	
95,160	650	.0228	.....	
102,480	700	.0253	.....	
109,800	750	.0280	.....	
117,120	800	.0310	.....	
124,440	850	.0234	.....	
131,760	900	.0378	.....	
139,080	950	.0412	.....	
146,400	1,000	.0450	.0160	E (600–1,000) = 1,389,000 pounds per square inch.
.....	600	.0329	.0159	
.....	600	.0326	.0158	
153,720	1,050	.0499	.....	
161,040	1,100	.0536	.....	
168,360	1,150	.0579	.....	
175,680	1,200	.0630	.0254	

No. 1798—Continued.

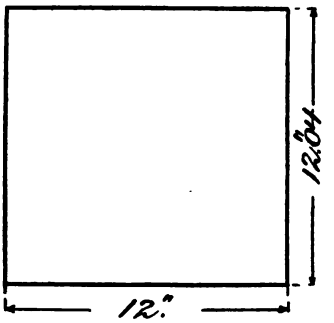
Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
.....	600	.0430	.0251	
.....	600	.0427	.0252	
183,000	1,250	.0731	.....	
190,320	1,300	.0782	.....	
197,640	1,350	.0836	.....	
204,960	1,400	.0925	.0435	
.....	600	.0627	.0430	
.....	600	.0625	.0431	
213,300	1,427	.....	.....	Ultimate strength.

Column failed near middle of height. Opened oblique and longitudinal cracks.

No. 1797.

1 : 0 : 5 Mixture.

Plain column, without reënforcing metal.



Composition, by volume: Saylor's Portland cement, 1; sand, 0; trap rock (crusher dust), 5.

Age, set in air, 7 months 24 days.

Weight of column, total, 1,055 pounds.

Weight of concrete, 1,055 pounds = 131.2 pounds per cubic foot.

Height of column, 96.10 inches.

Sectional area, $12'' \times 12''.04 = 144.48$ square inches.

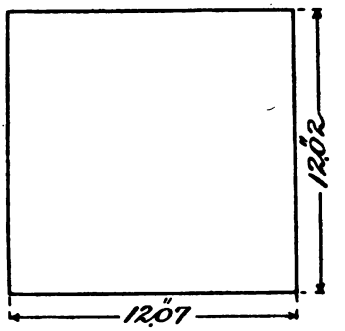
Gauged length, 50".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
14,488	100	0.	0.	Initial load. Loaded with 11,000 pounds before testing.
21,672	150	.0014	.0003	
28,896	200	.0028	.0005	
36,120	250	.0044	.0008	
43,344	300	.0064	.0014	
50,568	350	.0084	.0018	
57,792	400	.0106	.0024	
65,016	450	.0134	.0031	
72,240	500	.0161	.0040	
79,464	550	.0195	.0052	
86,688	600	.0228	.0064	E (100-600)=1,524,000 pounds per square inch.
.....	600	.0236	.0069	
93,912	650	.0267	.....	
101,136	700	.0298	.....	
108,360	750	.0340	.....	
115,584	800	.0385	.....	
122,808	850	.0438	.....	
130,032	900	.0500	.....	
137,256	950	.0569	.....	
144,480	1,000	.0675	.0300	E (600-1,000)=948,000 pounds per square inch.
.....	600	.0510	.0299	
.....	600	.0510	.0299	
151,704	1,050	.0820	.....	
158,928	1,100	.1005	.0540	
.....	600	.0785	.0540	Set after rest of half an hour.
.....	600	.0763	.0533	
161,400	1,117	.....	.....	Ultimate strength.

Column failed in upper half. Opened oblique and longitudinal cracks.

No. 1793.

1 : 0 : 6 Mixture.
Plain column, without reënforcing metal.



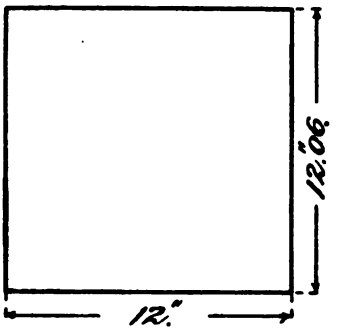
Composition, by volume: Saylor's Portland cement, 1; sand, 0; trap rock (crusher dust), 6. Water, 90 per cent of cement, by weight.
Age, set in air, 7 months 16 days.
Weight of column, total, 1,075 pounds.
Weight of concrete, 1,075 pounds = 132.7 pounds per cubic foot.
Height of column, 96.50 inches.
Sectional area, 12″.07 × 12″.02 = 145.08 square inches.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
14,508	100	0.	0.	Initial load. Loaded with 10,000 pounds before testing.
21,762	150	.0020	.0005	
29,016	200	.0038	.0010	
36,270	250	.0058	.0016	
43,524	300	.0080	.0020	
50,778	350	.0104	.0029	
58,032	400	.0130	.0037	
65,286	450	.0162	.0049	
72,540	500	.0195	.0061	
79,794	550	.0229	.0074	
87,048	600	.0269	.0088	E (100–600) = 1,381,000 pounds per square inch.
.....	600	.0279	.0098	
94,302	650	.0319	.....	
101,556	700	.0358	.....	
108,810	750	.0417	.....	
116,064	800	.0480	.....	
121,000	834	.....	.....	Ultimate strength.

Column failed at the upper end. Opened oblique and longitudinal cracks.

No. 1796.

1 : 0 : 7 Mixture.
Plain column, without reënforcing metal.

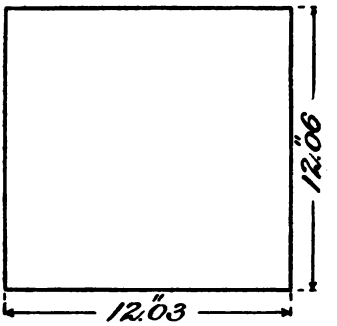


Composition, by volume: Saylor's Portland cement, 1; sand, 0; trap rock (crusher dust), 7. Water, 86.4 per cent of cement, by weight.
Age, set in air, 7 months 17 days.
Weight of column, total, 1,063 pounds.
Weight of concrete, 1,063 pounds = 132.2 pounds per cubic foot.
Height of column, 95.95 inches.
Sectional area, 12" × 12".06 = 144.72 square inches.
Gauged length, 50".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
14,472	100	0.	0.	Initial load. Loaded with 13,000 pounds before testing.
21,708	150	.0020	.0003	
28,944	200	.0042	.0009	
36,180	250	.0068	.0017	
43,416	300	.0095	.0027	
50,652	350	.0129	.0039	
57,888	400	.0165	.0050	
65,124	450	.0211	.0070	
72,360	500	.0259	.0093	
79,596	550	.0315	.0123	
86,832	600	.0376	.0154	E (100-600) = 1,126,000 pounds per square inch.
.....	600	.0398	.0175	
94,068	650	.0477	.....	
101,304	700	.0544	.....	
108,540	750	.0721	.0386	Ultimate strength.
.....	600	.0654	.0297	
.....	600	.0658	.0401	

No. 1792.

1 : 0 : 8 Mixture.
Plain column, without reënforcing metal.



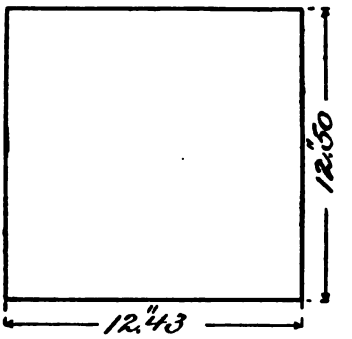
Composition, by volume: Saylor's Portland cement, 1; sand, 0; trap rock (crusher dust), 8. Water, 80 per cent of cement, by weight.
Age, set in air, 7 months 14 days.
Weight of column, total, 1,063 pounds.
Weight of concrete, 1,063 pounds = 131.7 pounds per cubic foot.
Height of column, 96.25 inches.
Sectional area, 12″.03 × 12″.04 = 144.84 square inches.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
14,484	100	0.	0.	Initial load. Loaded with 14,000 pounds before testing.
21,726	150	.0025	.0010	
28,968	200	.0058	.0019	
36,210	250	.0093	.0033	
43,452	300	.0133	.0051	
50,694	350	.0189	.0074	
57,936	400	.0250	.0106	
65,178	450	.0320	.0138	
72,420	500	.0399	.0194	
79,662	550	.0525	.0274	
86,904	600	.0685	.0394	E (100–600) = 859,000 pounds per square inch.
.....	600	.0746	.0446	
94,146	650	.0975	.....	
101,100	697	.....	.....	Ultimate strength.

Column failed at middle of height. Opened oblique and longitudinal cracks.

No. 1812.

1 : 0 : 2 Mixture.
Plain column, without reënforcing metal.



Composition, by volume: Alpha cement, 1; sand, 0; trap rock ($\frac{1}{8}$" to $\frac{1}{2}$"), 2. Water, 26.2 per cent of cement, by weight.
Age, set in air, 9 months.
Weight of column, total, 1,307 pounds.
Weight of concrete, 1,307 pounds = 150.7 pounds per cubic foot.
Height of column, 96.47 inches.
Sectional area, 12".43 × 12".50 = 155.38 square inches.
Gauged length, 50".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
15,538	100	0.	0.	Initial load. Loaded with 10,000 pounds before testing.
23,307	150	.0009	.0003	
31,076	200	.0015	.0001	
38,845	250	.0019	.0002	
46,614	300	.0026	.0003	
54,383	350	.0032	.0004	
62,152	400	.0040	.0006	
69,921	450	.0046	.0006	
77,690	500	.0054	.0006	
85,459	550	.0060	.0007	
93,228	600	.0066	.0009	E (100-600) = 4,386,000 pounds per square inch.
.....	600	.0068	.0009	
100,997	650	.0074	.....	
108,766	700	.0081	.....	
116,535	750	.0088	.....	
124,304	800	.0094	.....	
132,073	850	.0101	.....	
139,842	900	.0109	.....	
147,611	950	.0115	.....	
155,380	1,000	.0121	.0014	E (600-1,000) = 4,000,000 pounds per square inch.
.....	600	.0074	.0014	
.....	600	.0074	.0013	
170,918	1,100	.0135	.....	
186,456	1,200	.0150	.....	
201,994	1,300	.0165	.....	
217,532	1,400	.0181	.....	
233,070	1,500	.0195	.0021	E (1,000-1,500) = 3,731,000 pounds per square inch.
.....	600	.0082	.0021	
.....	600	.0082	.0021	
248,608	1,600	.0209	.....	
264,146	1,700	.0223	.....	

No. 1812—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
279,684	1,800	.0239	.....	
295,222	1,900	.0253	.....	
310,760	2,000	.0268	.0029	E (1,500-2,000)=3,846,000 pounds per square inch.
.....	600	.0093	.0028	
.....	600	.0092	.0028	
326,298	2,100	.0283	.....	
341,836	2,200	.0299	.....	
357,374	2,300	.0314	.....	
372,912	2,400	.0329	.....	
388,450	2,500	.0344	.0039	E (2,000-2,500)=3,788,000 pounds per square inch.
.....	600	.0104	.0038	
.....	600	.0103	.0036	
403,988	2,600	.0360	.....	
419,526	2,700	.0377	.....	
435,064	2,800	.0392	.....	
450,602	2,900	.0410	.....	
466,140	3,000	.0425	.0049	E (2,500-3,000)=3,521,000 pounds per square inch.
.....	600	.0116	.0048	
.....	600	.0115	.0048	
.....	100	.....	.0042	After resting half an hour under initial load.
.....	600	.0110	.....	
.....	1,000	.0168	.....	
.....	1,500	.0238	.....	
.....	2,000	.0300	.....	
.....	2,500	.0364	.....	
.....	2,000	.0310	.....	
.....	1,500	.0253	.....	
.....	1,000	.0187	.....	
.....	600	.0125	.0050	
800,000	5,149	.....	.....	Maximum load applied.

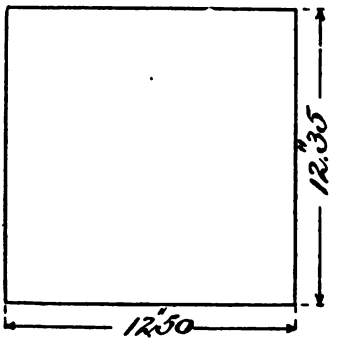
Additional micrometer observations after the column had been loaded with 800,000 pounds, the maximum load of the testing machine.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
.....	100	0.	0.	Micrometer reset at zero.
.....	600	.0081	.....	
.....	600	.0081	.....	
.....	1,000	.0148	.....	
.....	1,500	.0235	.....	
.....	2,000	.0316	.....	
.....	2,500	.0390	.....	
.....	3,000	.0465	.....	
.....	3,500	.0539	.....	
.....	4,000	.0611	.....	
.....	3,500	.0564	.....	
.....	3,000	.0506	.....	
.....	2,500	.0444	.....	
.....	2,000	.0375	.....	
.....	1,500	.0302	.....	
.....	1,000	.0218	.....	
.....	600	.0138	.0021	
.....	100	.....	.0012	After rest of 5 minutes.
.....	100	.....	.0010	After rest of 10 minutes.

Test discontinued. No apparent injury done the column.

No. 1788.

1 : 0 : 3 Mixture.
Plain column, without reënforcing metal



Composition, by volume: Alpha cement, 1; sand, 0; trap rock ($\frac{1}{8}$" to $\frac{1}{2}$"), 3. Water, 39.3 per cent of cement, by weight.
Age, set in air, 8 months 5 days.
Weight of column, total, 1,286 pounds.
Weight of concrete, 1,286 pounds = 149.4 pounds per cubic foot.
Height of column, 96.35 inches.
Sectional area, 12".35 × 12".50 = 154.38 square inches.
Gauged length, 50".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
15,438	100	0.	0.	Initial load. Loaded with 14,000 pounds before testing.
23,157	150	.0008	.0001	
30,876	200	.0017	.0002	
38,595	250	.0025	.0003	
46,314	300	.0034	.0005	
54,033	350	.0040	.0007	
61,752	400	.0050	.0008	
69,471	450	.0060	.0010	
77,190	500	.0068	.0011	
84,909	550	.0078	.0013	
92,628	600	.0089	.0015	E (100-600) = 3,378,000 pounds per square inch.
100,347	650	.0098	.....	
108,066	700	.0108	.....	
115,785	750	.0118	.....	
123,504	800	.0129	.....	
131,223	850	.0140	.....	
138,942	900	.0150	.....	
146,661	950	.0162	.....	
154,380	1,000	.0174	.0030	E (600-1,000) = 2,857,000 pounds per square inch.
.....	600	.0110	.0030	
.....	600	.0110	.0030	
169,818	1,100	.0197	.....	
185,256	1,200	.0221	.....	
200,694	1,300	.0247	.....	
216,132	1,400	.0278	.....	
231,570	1,500	.0304	.0063	E (1,000-1,500) = 2,577,000 pounds per square inch.
.....	600	.0151	.0063	
.....	600	.0149	.0061	
247,008	1,600	.0338	.....	
262,446	1,700	.0376	.....	

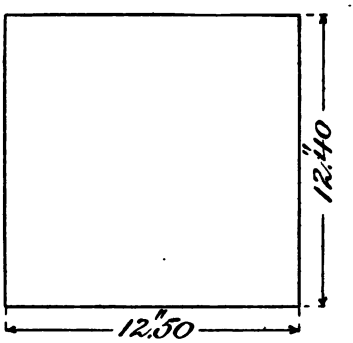
No. 1788—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
277,884	1,800	.0400	.....	
293,322	1,900	.0440	.....	
308,760	2,000	.0490	.0131	E (1,500-2,000)=2,119,000 pounds per square inch.
.....	600	.0233	.0130	
.....	600	.0231	.0127	
324,198	2,100	.0556	.0160	
339,636	2,200	.0625	.0198	
.....	600	.0315	.0196	
.....	600	.0316	.0196	
.....	200	.0214	.....	
.....	400	.0265	.....	
.....	600	.0312	.....	
.....	800	.0359	.....	
.....	1,000	.0403	.....	
.....	800	.0373	.....	
.....	600	.0334	.....	
.....	400	.0286	.....	
.....	200	.0228	.0199	
389,000	2,520	.....	.....	Ultimate strength.

Column failed by developing an oblique line of rupture at distance of 10″ to 30″ from upper end.

No. 1791.

1 : 0 : 4 Mixture.
Plain column, without reënforcing metal.



Composition, by volume: Alpha cement, 1; sand, 0; trap rock ($\frac{1}{8}$" to $\frac{1}{2}$"), 4. Water, 34.9 per cent of cement, by weight.
Age, set in air, 8 months 4 days.
Weight of column, total, 1,168 pounds.
Weight of concrete, 1,168 pounds = 135 pounds per square inch.
Height of column, 96.40 inches.
Sectional area, 12".50 × 12".40 = 155 square inches.
Gauged length, 50".
There were voids in this column, owing to the large deficiency of cement.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
15,500	100	0.	0.	Initial load. Loaded with 11,000 pounds before testing.
23,250	150	.0019	.0007	
31,000	200	.0039	.0012	
38,750	250	.0060	.0022	
46,500	300	.0089	.0029	
54,250	350	.0110	.0035	
62,000	400	.0133	.0042	
69,750	450	.0160	.0051	
77,500	500	.0188	.0062	
85,250	550	.0220	.0072	
93,000	600	.0253	.0084	E (100-600) = 1,479,000 pounds per square inch.
.....	600	.0262	.0091	
100,750	650	.0294	.....	
108,500	700	.0329	.....	
116,250	750	.0363	.....	
124,000	800	.0406	.....	
131,750	850	.0454	.....	
139,500	900	.0515	.....	
147,250	950	.0577	.....	
155,000	1,000	.0645	.0289	E (600-1,000) = 1,070,000 pounds per square inch.
.....	600	.0508	.0289	
.....	600	.0505	.0289	
.....	200	.0330	.....	
.....	400	.0421	.....	
.....	600	.0504	.....	

No. 1791—Continued.

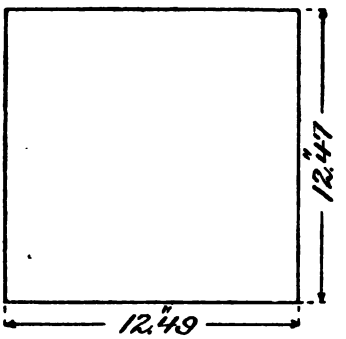
Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
.....	800	.0586	.....	
.....	600	.0530	.....	
.....	400	.0460	.....	
.....	200	.0360	.0293	
162,750	1,050	.0786	.....	
170,500	1,100	.0979	.0535	Ultimate strength.
.....	600	.0790	.0532	
.....	600	.0788	.0532	

Column failed near middle of height, opening an oblique fracture. Upon reloading, after the application of 1,100 pounds per square inch load, and observing behavior under 600 pounds per square inch, the column did not reach the maximum load, but failed under a total stress of 165,000 pounds.

17253—08——11

No. 1790.

1 : 0 : 1 Mixture.
Plain column, without reënforcing metal.



Composition, by volume: Alpha cement, 1; sand, 0; trap rock (¼" to 1½"), 1. Water, 29.1 per cent of cement, by weight.
Age, set in air, 8 months 11 days.
Weight of column, total, 1,249 pounds.
Weight of concrete, 1,249 pounds = 143.7 pounds per cubic foot.
Height of column, 96.40 inches.
Sectional area, 12".47 × 12".49 = 155.75 square inches.
Gauged length, 50".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
15,575	100	0.	0.	Initial load. Loaded with 12,000 pounds before testing.
23,363	150	.0007	.0002	
31,150	200	.0015	.0003	
38,938	250	.0021	.0004	
46,725	300	.0028	.0005	
54,513	350	.0035	.0006	
62,300	400	.0043	.0007	
70,088	450	.0050	.0007	
77,875	500	.0058	.0008	
85,663	550	.0065	.0008	
93,450	600	.0073	.0009	E (100–600) = 3,906,000 pounds per square inch.
.....	600	.0074	.0010	
101,238	650	.0083	.....	
109,025	700	.0090	.....	
116,813	750	.0099	.....	
124,600	800	.0107	.....	
132,388	850	.0114	.....	
140,175	900	.0125	.....	
147,963	950	.0133	.....	
155,750	1,000	.0141	.0016	E (600–1,000) = 3,279,000 pounds per square inch.
.....	600	.0084	.0015	
.....	600	.0083	.0015	
171,325	1,100	.0158	.....	
186,900	1,200	.0175	.....	
202,475	1,300	.0191	.....	
218,050	1,400	.0209	.....	
233,625	1,500	.0227	.0023	E (1,000–1,500) = 3,165,000 pounds per square inch.
.....	600	.0094	.0022	
.....	600	.0093	.0022	

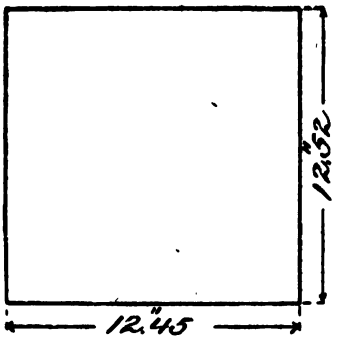
No. 1790—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
249,200	1,600	.0241	.....	
264,775	1,700	.0260	.....	
280,350	1,800	.0278	.....	
295,925	1,900	.0295	.....	
311,500	2,000	.0313	.0031	E (1,500–2,000) = 3,205,000 pounds per square inch.
327,075	2,100	.0333	.....	
342,650	2,200	.0351	.....	
358,225	2,300	.0368	.....	
373,800	2,400	.0386	.....	
389,375	2,500	.0405	.0044	E (2,000–2,500) = 3,165,000 pounds per square inch.
.....	600	.0119	.0043	
.....	600	.0120	.0041	
404,950	2,600	.0426	.....	
420,525	2,700	.0448	.....	
436,100	2,800	.0468	.....	
451,675	2,900	.0487	.....	
467,250	3,000	.0506	.0062	E (2,500–3,000) = 3,012,000 pounds per square inch.
.....	600	.0140	.0060	
.....	600	.0140	.0060	
482,825	3,100	.0535	.....	
498,400	3,200	.0559	{ .0074 / .0064 }	Set after resting half an hour.
.....	600	.0149	.0064	
.....	600	.0149	.0065	
643,000	4,128	.....	.....	Ultimate strength.

Column failed near upper end. Opened oblique and longitudinal cracks. A pyramidal fragment 22″ long was formed with base at upper end of column. Longitudinal fractures extended from the pyramidal fragment to the middle of the length of the column.

No. 1813.

1 : 0 : 1 Mixture.
Plain column, without reënforcing metal.



Composition, by volume: Alpha cement, 1; sand, 0; trap rock ($\frac{1}{4}$" to 1$\frac{1}{2}$"), 1. Water, 29.1 per cent of cement, by weight.
Age, set in air, 9 months 9 days.
Weight of column, total, 1,262 pounds.
Weight of concrete, 1,262 pounds = 145.7 pounds per cubic foot.
Height of column, 96.02 inches.
Sectional area, 12".45 × 12".52 = 155.87 square inches.
Gauged length, 50".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
15,567	100	0.	0.	Initial load. Loaded with 10,000 pounds before testing.
23,381	150	.0005	0.	
31,174	200	.0011	.0001	
38,968	250	.0019	.0002	
46,761	300	.0028	.0002	
54,555	350	.0034	.0003	
62,348	400	.0041	.0005	
70,142	450	.0050	.0007	
77,935	500	.0059	.0008	
85,729	550	.0065	.0009	
93,522	600	.0071	.0010	E (100-600) = 4,098,000 pounds per square inch.
.....	600	.0074	.0011	
101,316	650	.0081	.....	
109,109	700	.0088	.....	
116,903	750	.0095	.....	
124,696	800	.0105	.....	
132,490	850	.0110	.....	
140,283	900	.0120	.....	
148,077	950	.0128	.....	
155,870	1,000	.0135	.0016	E (600-1,000) = 3,448,000 pounds per square inch.
.....	600	.0081	.0017	
.....	600	.0082	.0015	
171,457	1,100	.0150	.....	
187,084	1,200	.0168	.....	
202,631	1,300	.0184	.....	
218,218	1,400	.0200	.....	
233,805	1,500	.0218	.0021	E (1,000-1,500) = 3,206,000 pounds per square inch.
.....	600	.0091	.0021	
.....	600	.0091	.0022	

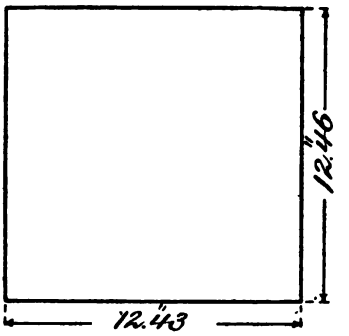
No. 1813—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
249,392	1,600	.0235	.....	
264,979	1,700	.0250	.....	
280,566	1,800	.0266	.....	
296,153	1,900	.0280	.....	
311,740	2,000	.0297	.0034	E (1,500-2,000)=3,788,000 pounds per square inch.
.....	600	.0100	.0033	
.....	600	.0100	.0031	
.....	100	.....	.0021	After resting under initial load 16 hours.
.....	600	.0094	.0024	
327,327	2,100	.0315	.....	
342,914	2,200	.0333	.....	
358,501	2,300	.0350	.....	
374,088	2,400	.0365	.....	
389,675	2,500	.0380	.0045	E (2,000-2,500)=3,472,000 pounds per square inch.
.....	600	.0115	.0044	
.....	600	.0114	.0044	
405,262	2,600	.0394	.....	
420,849	2,700	.0410	.....	
436,436	2,800	.0425	.....	
452,023	2,900	.0444	.....	
467,610	3,000	.0460	.0056	E (2,500-3,000)=3,623,000 pounds per square inch.
.....	600	.0129	.0052	
.....	600	.0130	.0052	
483,197	3,100	.0478	.....	
498,784	3,200	.0498	.0061	
.....	600	.0137	.0061	
.....	600	.0136	.0055	
.....	600	.0130	.0055	
.....	600	.0129	.....	
.....	1,000	.0194	.....	
.....	1,500	.0268	.....	
.....	2,000	.0337	.....	
.....	2,500	.0404	.....	
.....	3,000	.0470	.....	
.....	2,500	.0413	.....	
.....	2,000	.0352	.....	
.....	1,500	.0288	.....	
.....	1,000	.0216	.....	
.....	600	.0150	.0062	
792,000	5,081	.....	.....	Ultimate strength.

Column failed at the upper end. A pyramidal-shaped fragment developed, the base being the upper end of the column, from the apex of which longitudinal cracks were formed.

No. 1810.

1 : 0 : 2 Mixture.
Plain column, without reënforcing metal.



Composition, by volume: Alpha cement, 1; sand, 0; trap rock ($\frac{3}{4}$" to $1\frac{1}{2}$"), 2. Water, 15.3 per cent of cement, by weight.
Age, set in air, 9 months 8 days.
Weight of column, total, 1,309 pounds.
Weight of concrete, 1,309 pounds = 151.7 pounds per cubic foot.
Height of column, 96.32 inches.
Sectional area, 12".46 × 12".43 = 154.88 square inches.
Gauged length, 50".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
15,448	100	0.	0.	Initial load. Loaded with 12,000 pounds before testing.
23,232	150	.0007	0.	
30,976	200	.0015	.0002	
38,720	250	.0023	.0004	
46,464	300	.0030	.0005	
54,208	350	.0039	.0007	
61,952	400	.0048	.0008	
69,696	450	.0058	.0010	
77,440	500	.0068	.0010	
85,184	550	.0076	.0012	
92,928	600	.0086	.0013	E (100–600) = 3,425,000 pounds per square inch.
.....	600	.0086	.0014	
100,672	650	.0095	.....	
108,416	700	.0104	.....	
116,160	750	.0115	.....	
123,904	800	.0124	.....	
131,648	850	.0134	.....	
139,392	900	.0144	.....	
147,136	950	.0153	.....	
154,880	1,000	.0164	.0025	E (600–1,000) = 3,030,000 pounds per square inch.
.....	600	.0105	.0025	
.....	600	.0104	.0025	
170,368	1,100	.0184	.....	
185,856	1,200	.0205	.....	
201,344	1,300	.0226	.....	
216,832	1,400	.0248	.....	
232,320	1,500	.0273	.0046	E (1,000–1,500) = 2,841,000 pounds per square inch.
.....	600	.0133	.0046	
.....	600	.0133	.0046	

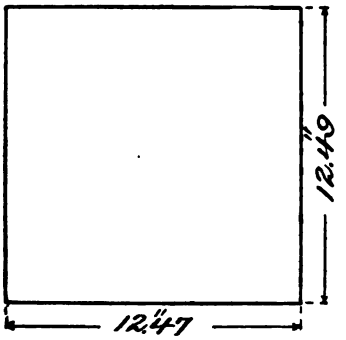
No. 1810—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
247,808	1,600	.0299	.....	
263,296	1,700	.0322	.....	
278,784	1,800	.0345	.....	
294,272	1,900	.0375	.....	
309,760	2,000	.0406	.0084	E (1,500-2,000)=2,632,000 pounds per square inch.
.....	600	.0184	.0083	
.....	600	.0184	.0083	
325,248	2,100	.0454	.....	
340,736	2,200	.0482	.....	
356,224	2,300	.0510	.....	
371,712	2,400	.0549	.....	
387,200	2,500	.0599	.0160	E (2,000-2,500)=2,137,000 pounds per square inch.
.....	600	.0279	.0159	
.....	600	.0277	.0156	
431,000	2,783	.....	.....	Ultimate strength.

Column failed at middle of height. Opened short oblique and longitudinal cracks.

No. 1811.

1 : 0 : 2 Mixture.
Plain column, without reënforcing metal.



Composition, by volume: Alpha cement, 1; sand, 0; trap rock ($\frac{1}{4}$" to 1$\frac{1}{2}$"), 2. Water, 15.3 per cent of cement, by weight.
Age, set in air, 9 months 11 days.
Weight of column, total, 1,324 pounds.
Weight of concrete, 1,324 pounds = 152.5 pounds per cubic foot.
Height of column, 96.32 inches.
Sectional area, 12".47 × 12".49 = 155.75 square inches.
Gauged length, 50".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
15,575	150	0.	0.	Initial load. Remained under 18,000 pounds total load 40 hours preceding the test.
23,363	150	.0004	0.	
31,150	200	.0009	0.	
38,938	250	.0014	.0001	
46,725	300	.0020	.0002	
54,513	350	.0025	.0003	
62,300	400	.0032	.0003	
70,088	450	.0039	.0004	
77,875	500	.0046	.0005	
85,663	550	.0054	.0007	
93,450	600	.0061	.0007	E (100-600) = 4,630,000 pounds per square inch.
.....	600	.0061	.0007	
101,238	650	.0069	.....	
109,025	700	.0077	.....	
116,813	750	.0083	.....	
124,600	800	.0092	.....	
132,388	850	.0100	.....	
140,175	900	.0107	.....	
147,963	950	.0114	.....	
155,750	1,000	.0123	.0014	E (600-1,000) = 3,636,000 pounds per square inch.
.....	600	.0072	.0014	
.....	600	.0073	.0014	
171,325	1,100	.0139	.....	
186,900	1,200	.0154	.....	
202,475	1,300	.0171	.....	
218,050	1,400	.0190	.....	
233,625	1,500	.0208	.0024	E (1,000-1,500) = 3,333,000 pounds per square inch.
.....	600	.0089	.0024	
.....	600	.0089	.0024	

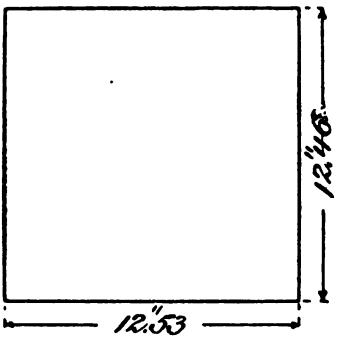
No. 1811—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
249,200	1,600	.0226	.....	
264,775	1,700	.0246	.....	
280,350	1,800	.0262	.....	
295,925	1,900	.0283	.....	
311,500	2,000	.0300	.0041	E (1,500-2,000)=3,333,000 pounds per square inch.
.....	600	.0111	.0041	
.....	600	.0111	.0041	
327,075	2,100	.0326	.....	
342,650	2,200	.0344	.....	
358,225	2,300	.0364	.....	
373,800	2,400	.0389	.....	
389,375	2,500	.0413	.0070	E (2,000-2,500)=2,976,000 pounds per square inch.
.....	600	.0149	.0069	
.....	600	.0148	.0068	
404,950	2,600	.0446	.....	
420,525	2,700	.0472	.....	
436,100	2,800	.0493	.0093	
.....	600	.0180	.0089	
.....	600	.0177	.0089	
528,000	3,390	.....	.....	Ultimate strength.

Column failed along the middle of its height. Developed a long, oblique fracture.

No. 1789.

1 : 0 : 3 Mixture.
Plain column, without reënforcing metal.



Composition, by volume: Alpha cement, 1; sand, 0; trap rock ($\frac{3}{4}$" to $1\frac{1}{2}$"), 3. Water, 26.2 per cent of cement, by weight.
Age, set in air, 8 months 8 days.
Weight of column, total, 1,312 pounds.
Weight of concrete, 1,312 pounds = 150.8 pounds per cubic foot.
Height of column, 96.30 inches.
Sectional area, 12".53 × 12".46 = 156.12 square inches.
Gauged length, 50".
There were voids in this column, revealed upon stripping the mold. The voids were patched up with neat cement.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
15,612	100	0.	0.	Initial load. Loaded with 13,000 pounds before testing.
23,418	150	.0007	.0001	
31,224	200	.0018	.0004	
39,030	250	.0028	.0006	
46,836	300	.0040	.0008	
54,642	350	.0051	.0010	
62,448	400	.0063	.0013	
70,250	450	.0077	.0016	
78,060	500	.0088	.0019	
85,866	550	.0100	.0023	
93,672	600	.0119	.0030	E (100–600) = 2,809,000 pounds per square inch.
.....	600	.0122	.0030	
101,478	650	.0135	.....	
109,284	700	.0149	.....	
117,090	750	.0158	.....	
124,896	800	.0175	.....	
132,702	850	.0193	.....	
140,508	900	.0202	.....	
148,314	950	.0220	.....	
156,120	1,000	.0237	.0063	E (600–1,000) = 2,353,000 pounds per square inch.
.....	600	.0187	.0078	
.....	600	.0183	.0078	
171,732	1,100	.0290	.....	
187,344	1,200	.0324	.....	
202,956	1,300	.0361	.....	

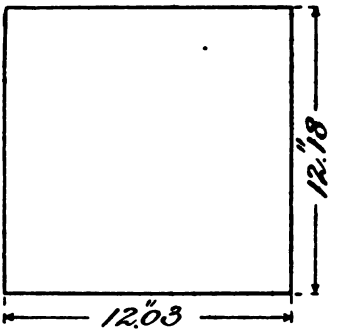
No. 1789—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
218,568	1,400	.0398	.....	
234,180	1,500	.0445	.0145	E (1,000-1,500)=1,964,000 pounds per square inch.
.....	600	.0296	.0146	
249,792	1,600	.0523	.....	
265,404	1,700	.0572	.....	
281,016	1,800	.0655	.....	
296,628	1,900	.0765	.0335	Snapping sounds.
.....	600	.0490	.0331	
.....	600	.0486	.0329	
.....	200	.0357	.....	
.....	400	.0425	.....	
.....	600	.0485	.....	
.....	800	.0534	.....	
.....	1,000	.0582	.....	
.....	800	.0550	.....	
.....	600	.0512	.....	
.....	400	.0458	.....	
.....	200	.0380	.0335	
307,500	1,970	.....	.....	Ultimate strength.

Column failed near middle of its height, at place which had been patched to close voids, originally in the material. Developed oblique and longitudinal cracks. There were voids in the interior of the column, not reached and filled by the cement used in patching the surface.

No. 1802.

1 : 0 : 2 Mixture.
Plain column, without reënforcing metal.



Composition, by volume: Saylor's Portland cement, 1; sand, 0; trap rock (crusher dust 1, $\frac{1}{8}$″ to $\frac{1}{2}$″ 1), 2.
Age, set in air, 7 months 19 days.
Weight of column, total, 1,157 pounds.
Weight of concrete, 1,157 pounds = 141.4 pounds per cubic foot.
Height of column, 96.50 inches.
Sectional area, 12″.18 × 12″.03 = 156.52 square inches.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
14,652	100	0.	0.	Initial load. Loaded with 12,000 pounds before testing.
21,978	150	.0006	0.	
29,304	200	.0010	.0001	
36,630	250	.0018	.0001	
43,956	300	.0023	.0002	
51,282	350	.0029	.0002	
58,608	400	.0038	.0005	
65,934	450	.0045	.0006	
73,260	500	.0053	.0007	
80,586	550	.0061	.0009	
87,912	600	.0070	.0010	E (100–600) = 4,167,000 pounds per square inch.
.....	600	.0071	.0009	
95,238	650	.0078	.....	
102,564	700	.0085	.....	
109,890	750	.0095	.....	
117,216	800	.0103	.....	
124,542	850	.0113	.....	
131,868	900	.0120	.....	
139,194	950	.0130	.....	
146,520	1,000	.0139	.0019	E (600–1,000) = 3,333,000 pounds per square inch.
.....	600	.0080	.0018	
.....	600	.0081	.0019	
161,172	1,100	.0155	.....	
175,824	1,200	.0178	.....	
190,476	1,300	.0194	.....	
205,128	1,400	.0218	.....	
219,780	1,500	.0238	.0033	E (1,000–1,500) = 2,941,000 pounds per square inch.
.....	600	.0096	.0031	
.....	600	.0096	.0031	

No. 1802—Continued.

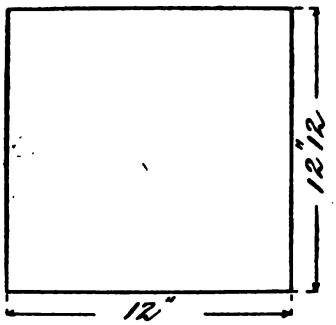
Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
234,432	1,600	.0259	.....	
249,084	1,700	.0278	.....	
263,736	1,800	.0300	.....	
278,388	1,900	.0320	.....	
293,040	2,000	.0344	.0051	E (1,500-2,000) = 2,841,000 pounds per square inch.
.....	600	.0120	.0049	
.....	600	.0116	.0048	
307,692	2,100	.0367	.....	
322,344	2,200	.0391	.....	
336,996	2,300	.0418	.....	
351,648	2,400	.0445	.....	
366,300	2,500	.0475	.0078	E (2,000-2,500) = 2,404,000 pounds per square inch.
.....	600	.0150	.0077	
.....	600	.0148	.0076	
549,900	3,753	.....	.....	Ultimate strength.

Column failed along middle of its height, developing an oblique crack 3 feet long, separating the column into two parts.

No. 1801.

1 : 0 : 4 Mixture.

Plain column, without reënforcing metal.



Composition, by volume: Saylor's Portland cement, 1; sand, 0; trap rock (crusher dust 2, $\frac{1}{8}$" to $\frac{1}{2}$" 2), 4. Water, 48 per cent of cement, by weight.

Age, set in air, 7 months 14 days.

Weight of column, total, 1,155 pounds.

Weight of concrete, 1,155 pounds = 142.6 pounds per cubic foot.

Height of column, 96.20 inches.

Sectional area, 12".12 × 12" = 145.44 square inches.

Gauged length, 50".

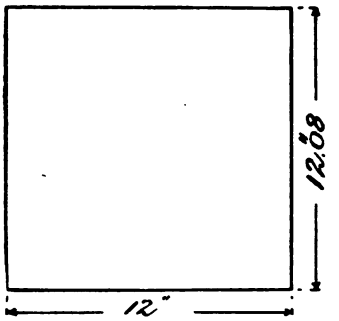
Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
14,544	100	0.	0.	Initial load.. Loaded with 12,000 pounds before testing.
21,816	150	.0009	0.	
29,088	200	.0019	.0001	
36,360	250	.0030	.0003	
43,632	300	.0042	.0004	
50,904	350	.0055	.0005	
58,176	400	.0065	.0008	
65,448	450	.0079	.0013	
72,720	500	.0090	.0012	
79,992	550	.0103	.0014	
87,264	600	.0119	.0018	E (100-600) = 2,475,000 pounds per square inch.
.....	600	.0120	.0019	
94,536	650	.0133	.....	
101,808	700	.0146	.....	
109,080	750	.0166	.....	
116,352	800	.0180	.....	
123,624	850	.0197	.....	
130,896	900	.0216	.....	
138,968	950	.0233	.....	
145,440	1,000	.0249	.0053	E (600-1,000) = 2,105,000 pounds per square inch.
.....	600	.0159	.0050	
.....	600	.0159	.0050	
159,984	1,100	.0295	.....	
174,528	1,200	.0328	.....	
189,072	1,300	.0378	.....	
203,616	1,400	.0446	.....	
218,160	1,500	.0501	.0150	E (1,000-1,500) = 1,613,000 pounds per square inch.
.....	600	.0278	.0148	
.....	600	.0276	.0146	
232,704	1,600	.0589	.....	
247,248	1,700	.0669	.....	
261,792	1,800	.0780	.....	
275,300	1,893	.....	.....	Ultimate strength.

Column failed in the upper half. Opened oblique and longitudinal cracks.

No. 1795.

1 : 0 : 6 Mixture.

Plain column without reënforcing metal.



Composition, by volume: Saylor's Portland cement, 1; sand, 0; trap rock (crusher dust 3, $\frac{1}{8}$" to $\frac{1}{2}$" 3), 6. Water, 72 per cent of cement, by weight.

Age, set in air, 7 months 12 days.

Weight of column, total, 1,146 pounds.

Weight of concrete, 1,146 pounds = 141.8 pounds per cubic foot.

Height of column, 96.30 inches.

Sectional area, 12" × 12".08 = 144.96 square inches.

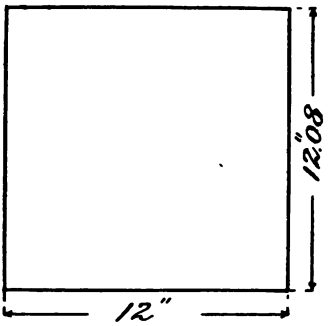
Gauged length, 50".

Applied loads.		In gauged lengths.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
14,496	100	0.	0.	Initial load. Loaded with 12,000 pounds before testing.
21,744	150	.0015	.0005	
28,992	200	.0033	.0008	
36,240	250	.0050	.0014	
43,488	300	.0069	.0019	
50,736	350	.0089	.0025	
57,984	400	.0113	.0036	
65,232	450	.0140	.0046	
72,480	500	.0168	.0059	
79,728	550	.0195	.0070	
86,976	600	.0235	.0090	E (100-600) = 1,724,000 pounds per square inch.
.....	600	.0242	.0096	
94,224	650	.0279	.....	
101,472	700	.0311	.....	
108,720	750	.0365	.....	
115,968	800	.0429	.....	
123,216	850	.0499	.....	
130,464	900	.0626	.....	
137,712	950	.0910	.....	Ultimate strength.

Column failed near middle of height. Opened oblique cracks.

No. 1800.

1 : 0 : 8 Mixture.
Plain column, without reënforcing metal.



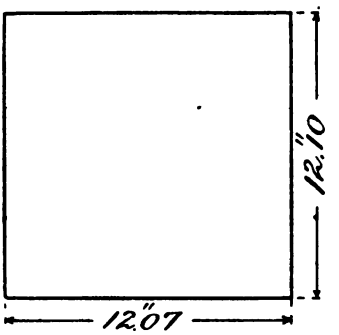
Composition, by volume: Saylor's Portland cement, 1; sand, 0; trap rock (crusher dust 4, $\frac{1}{8}$" to $\frac{1}{2}$" 4), 8. Water, 72 per cent of cement, by weight.
Age, set in air, 7 months 12 days.
Weight of column, total, 1,129 pounds.
Weight of concrete, 1,129 pounds = 139.7 pounds per cubic foot.
Height of column, 96.35 inches.
Sectional area, 12" × 12".08 = 144.96 square inches.
Gauged length, 50".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
14,496	100	0.	0.	Initial load. Loaded with 12,000 pounds before testing.
21,744	150	.0009	0.	
28,992	200	.0026	.0003	
36,240	250	.0043	.0003	
43,488	300	.0064	.0013	
50,736	350	.0084	.0019	
57,984	400	.0107	.0027	
65,232	450	.0135	.0035	
72,480	500	.0166	.0049	
79,728	500	.0198	.0058	
86,976	600	.0237	.0076	E (100-600) = 1,553,000 pounds per square inch.
.....	600	.0246	.0084	
94,224	650	.0280	.....	
101,472	700	.0318	.....	
108,720	750	.0359	.....	
115,968	800	.0425	.....	
123,216	850	.0498	.....	
130,464	900	.0595	.0300	
.....	600	.0494	.0300	
.....	600	.0495	.0303	
131,100	904	.....	.....	Ultimate strength.

Column failed near lower end. Opened oblique and longitudinal cracks.

No. 1808.

1 : 0 : 1 Mixture.
Plain column, without reënforcing metal.



Composition, by volume: Saylor's Portland cement, 1; sand, 0; trap rock ($\frac{1}{8}$″ to $\frac{1}{2}$″ $\frac{1}{2}$, $\frac{3}{4}$″ to 1$\frac{1}{2}$″ $\frac{1}{2}$), 1. Water, 21.3 per cent of cement, by weight.
Age, set in air, 7 months 19 days.
Weight of column, total, 1,176 pounds.
Weight of concrete, 1,176 pounds = 144.5 pounds per cubic foot.
Height of column, 96.40 inches.
Sectional area, 12″.10 × 12″.07 = 146.05 square inches.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
14,605	100	0.	0.	Initial load. Loaded with 11,000 pounds before testing.
21,908	150	.0009	0.	
29,210	200	.0015	.0001	
36,513	250	.0024	.0003	
43,815	300	.0030	.0005	
51,118	350	.0039	.0006	
58,420	400	.0047	.0006	
65,723	450	.0054	.0007	
73,025	500	.0062	.0008	
80,328	550	.0072	.0009	
87,630	600	.0081	.0010	E (100–600) = 3,521,000 pounds per square inch.
.....	600	.0081	.0010	
94,933	650	.0089	.....	
102,235	700	.0099	.....	
109,538	750	.0107	.....	
116,840	800	.0117	.....	
124,143	850	.0126	.....	
131,445	900	.0135	.....	
138,748	950	.0143	.....	
146,050	1,000	.0153	.0020	E (600–1,000) = 3,226,000 pounds per square inch.
.....	600	.0093	.0020	
.....	600	.0094	.0017	
160,655	1,100	.0170	.....	
175,260	1,200	.0188	.....	
189,865	1,300	.0207	.....	
204,470	1,400	.0225	.....	
219,075	1,500	.0236	.0030	E (1,000–1,500) = 3,425,000 pounds per square inch.

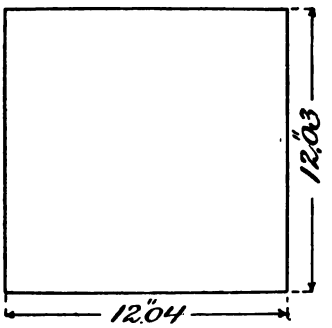
No. 1808—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
.....	600	.0108	.0030	
.....	600	.0108	.0030	
233,680	1,600	.0265	.....	
248,285	1,700	.0283	.....	
262,890	1,800	.0302	.....	
277,495	1,900	.0319	.....	
292,100	2,000	.6338	.0046	E (1,500-2,000)=2,907,000 pounds per square inch.
.....	600	.0125	.0044	
.....	600	.0125	.0043	
306,705	2,100	.0359	.....	
321,310	2,200	.0380	.....	
335,915	2,300	.0397	.....	
350,520	2,400	.0416	.....	
365,125	2,500	.0438	.0060	E (2,000-2,500)=2,907,000 pounds per square inch.
.....	600	.0142	.0055	
.....	600	.0140	.0055	
639,000	4,375	.....	.....	Ultimate strength.

Column failed in the upper half. Opened oblique and longitudinal cracks.

No. 1807.

1 : 0 : 2 Mixture.
Plain column, without reënforcing metal.



Composition, by volume: Saylor's Portland cement, 1; sand, 0; trap rock ($\frac{1}{8}$″ to $\frac{1}{2}$″ 1, $\frac{3}{4}$″ to 1$\frac{1}{2}$″ 1), 2. Water, 27 per cent of cement, by weight.
Age, set in air, 7 months 20 days.
Weight of column, total, 1,225 pounds.
Weight of concrete, 1,225 pounds = 151.2 pounds per cubic foot.
Height of column, 96.50 inches.
Sectional area, 12″.06 × 12″.03 = 145.08 square inches.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
14,508	100	0.	0.	Initial load. Loaded with 11,000 pounds before testing.
21,762	150	.0005	0.	
29,016	200	.0011	0.	
36,270	250	.0019	0.	
43,524	300	.0025	0.	
50,778	350	.0032	0.	
58,032	400	.0040	.0001	
65,286	450	.0049	.0002	
72,540	500	.0057	.0003	
79,794	550	.0067	.0004	
87,048	600	.0076	.0005	E (100–600) = 3,521,000 pounds per square inch.
.....	600	.0076	.0005	
94,302	650	.0086	.....	
101,556	700	.0093	.....	
108,810	750	.0104	.....	
116,064	800	.0113	.....	
123,318	850	.0122	.....	
130,572	900	.0133	.....	
137,826	950	.0143	.....	
145,080	1,000	.0152	.0017	E (600–1,000) = 3,125,000 pounds per square inch.
.....	600	.0094	.0017	
.....	600	.0094	.0017	
159,588	1,100	.0176	.....	
174,096	1,200	.0196	.....	
188,604	1,300	.0218	.....	
203,112	1,400	.0239	.....	
217,620	1,500	.0268	.0038	E (1,000–1,500) = 2,632,000 pounds per square inch.

No. 1807—Continued.

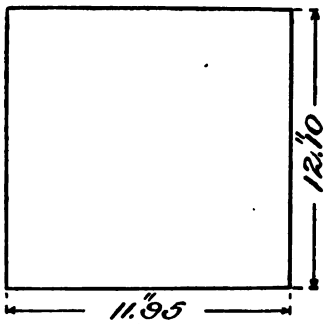
Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
.....	600	.0124	.0039	
.....	600	.0124	.0039	
232,128	1,600	.0294	.....	
246,636	1,700	.0316	.....	
261,144	1,800	.0340	.....	
275,652	1,900	.0367	.....	
290,160	2,000	.0400	.0075	E (1,500-2,000)=2,632,000 pounds per square inch.
.....	600	.0170	.0075	
.....	600	.0170	.0075	
304,668	2,100	.0442	.....	
319,176	2,200	.0468	.....	
333,684	2,300	.0497	.....	
348,192	2,400	.0532	.....	
362,700	2,500	.0570	.0136	E (2,000-2,500)=2,294,000 pounds per square inch.
.....	600	.0245	.0135	
.....	600	.0243	.0133	
409,000	2,819	.....	.....	Ultimate strength.

Column failed in the upper half. Opened oblique and longitudinal cracks.

No. 1806.

1 : 0 : 3 Mixture.

Plain column, without reënforcing metal.



Composition, by volume: Saylor's Portland cement, 1; sand, 0; trap rock ($\frac{1}{8}$″ to $\frac{1}{2}$″ $1\frac{1}{2}$, $\frac{3}{4}$″ to $1\frac{1}{2}$″ $1\frac{1}{2}$), 3. Water, 30 per cent of cement, by weight.

Age, set in air, 7 months 4 days.

Weight of column, total, 1,232 pounds.

Weight of concrete, 1,232 pounds = 152.9 pounds per cubic foot.

Height of column, 96.30 inches.

Sectional area, 11″.95 × 12″.10 = 144.60 square inches.

Gauged length, 50″.

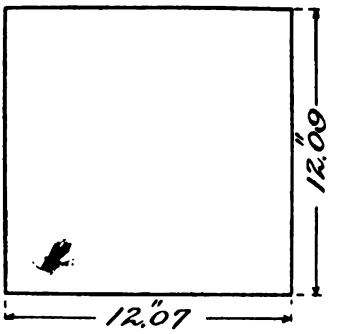
Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
14,460	100	0.	0.	Initial load. Loaded with 11,000 pounds before testing.
21,690	150	.0006	.0001	
28,920	200	.0011	.0003	
36,150	250	.0017	.0003	
43,380	300	.0026	.0005	
50,610	350	.0034	.0006	
57,840	400	.0042	.0006	
65,070	450	.0051	.0007	
72,300	500	.0061	.0009	
79,530	550	.0072	.0011	
86,760	600	.0081	.0012	E (100–600) = 3,623,000 pounds per square inch.
.....	600	.0083	.0015	
93,990	650	.0092	.....	
101,220	700	.0103	.....	
108,450	750	.0114	.....	
115,680	800	.0124	.....	
122,910	850	.0137	.....	
130,140	900	.0147	.....	
137,370	950	.0161	.....	
144,600	1,000	.0174	.0034	E (600–1,000) = 2,817,000 pounds per square inch.
.....	600	.0111	.0034	
159,060	1,100	.0197	.....	
173,520	1,200	.0224	.....	
187,980	1,300	.0255	.....	
202,440	1,400	.0283	.....	
216,900	1,500	.0318	.0079	E (1,000–1,500) = 2,525,000 pounds per square inch.
.....	600	.0171	.0078	
.....	600	.0171	.0077	
231,360	1,600	.0395	.....	
245,820	1,700	.0420	.....	
260,280	1,800	.0472	.....	
272,000	1,881	.....	.....	Ultimate strength.

Column failed near the lower end. Opened oblique cracks.

No. 1805.

1 : 1 : 1 Mixture.

Plain column, without reënforcing metal.



Composition, by volume: Saylor's Portland cement, 1; sand (10-mesh sieve), 1; trap rock ($\frac{1}{8}$" to $\frac{1}{2}$"), 1. Water, 36 per cent of cement, by weight.

Age, set in air, 7 months 10 days.

Weight of column, total, 1,156 pounds.

Weight of concrete, 1,156 pounds = 141.8 pounds per cubic foot.

Height of column, 96.52 inches.

Sectional area, 12".07 × 12".09 = 145.92 square inches.

Gauged length, 50".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
14,592	100	0.	0.	Initial load. Loaded with 10,000 pounds before testing.
21,888	150	.0004	0.	
29,184	200	.0009	0.	
36,480	250	.0017	0.	
43,776	300	.0024	0.	
51,072	350	.0030	0.	
58,368	400	.0038	.0002	
65,664	450	.0047	.0002	
72,960	500	.0055	.0002	
80,256	550	.0063	.0004	
87,552	600	.0072	.0004	E (100–600) = 3,676,000 pounds per square inch.
.....	600	.0073	.0006	
94,848	650	.0083	.....	
102,144	700	.0092	.....	
109,440	750	.0099	.....	
116,736	800	.0109	.....	
124,032	850	.0119	.....	
131,328	900	.0128	.....	
138,624	950	.0140	.....	
145,920	1,000	.0149	.0014	E (600–1,000) = 2,985,000 pounds per square inch.
.....	600	.0084	.0016	
.....	600	.0086	.0016	
160,512	1,100	0168	.....	
175,104	1,200	.0188	.....	
189,696	1,300	.0212	.....	
204,288	1,400	.0233	.....	
218,880	1,500	.0252	.0027	E (1,000–1,500) = 2,778,000 pounds per square inch.

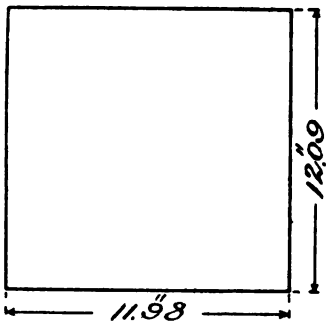
No. 1805—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
.....	600	.0101	.0027	
.....	600	.0102	.0027	
233,472	1,600	.0275	.....	
248,064	1,700	.0298	.....	
262,656	1,800	.0320	.....	
277,248	1,900	.0344	.....	
291,840	2,000	.0370	.0049	E (1,500–2,000)=2,604,000 pounds per square inch.
.....	600	.0124	.0049	
.....	600	.0125	.0049	
306,432	2,100	.0394	.....	
321,024	2,200	.0427	.....	
335,616	2,300	.0453	.....	
350,208	2,400	.0482	.....	
364,800	2,500	.0519	.0080	E (2,000–2,500)=2,119,000 pounds per square inch.
.....	600	.0167	.0078	
.....	600	.0163	.0078	
514,000	3,522	.....	.....	Ultimate strength.

Column failed in the upper half of its height. Opened oblique and longitudinal lines of fracture.

No. 1804.

1 : 2 : 2 Mixture.
Plain column, without reënforcing metal.



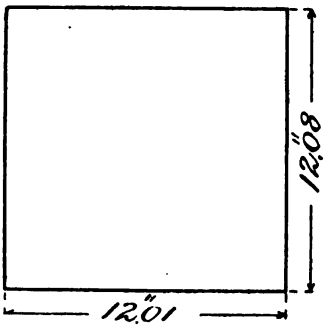
Composition, by volume: Saylor's Portland cement, 1; sand (10-mesh sieve), 2; trap rock ($\frac{1}{8}$" to $\frac{1}{2}$"), 2. Water, 50.4 per cent of cement, by weight.
Age, set in air, 7 months 8 days.
Weight of column, total, 1,149 pounds.
Weight of concrete, 1,149 pounds = 142 pounds per cubic foot.
Height of column, 96.46 inches.
Sectional area, 11".98 × 12".09 = 144.84 square inches.
Gauged length, 50".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
14,484	100	0.	0.	Initial load. Loaded with 13,000 pounds before testing.
21,726	150	.0009	.0003	
28,968	200	.0015	.0003	
36,210	250	.0024	.0005	
43,452	300	.0032	.0007	
50,694	350	.0045	.0008	
57,936	400	.0056	.0009	
65,178	450	.0066	.0012	
72,420	500	.0078	.0014	
79,662	550	.0092	.0018	
86,904	600	.0104	.0020	E (100–600) = 2,976,000 pounds per square inch.
.....	600	.0106	.0021	
94,146	650	.0120	.....	
101,388	700	.0133	.....	
108,630	750	.0146	.....	
115,872	800	.0161	.....	
123,114	850	.0176	.....	
130,356	900	.0193	.....	
137,598	950	.0213	.....	
144,840	1,000	.0233	.0053	E (600–1,000) = 2,083,000 pounds per square inch.
.....	600	.0150	.0054	
.....	600	.0150	.0052	
159,324	1,100	.0270	.....	
173,808	1,200	.0312	.....	
188,292	1,300	.0375	.....	
192,000	1,326	.....	.....	Ultimate strength.

Column failed at the lower end. Opened oblique and longitudinal cracks.

No. 1803.

1 : 3 : 3 Mixture.
Plain column, without reënforcing metal.



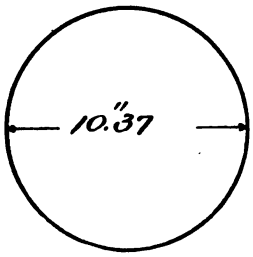
Composition, by volume: Saylor's Portland cement, 1; sand (10-mesh sieve), 3; trap rock ($\frac{1}{8}$" to $\frac{1}{2}$"), 3. Water, 62.3 per cent of cement, by weight.
Age, set in air, 7 months 5 days.
Weight of column, total, 1,106 pounds.
Weight of concrete, 1,106 pounds = 136.7 pounds per cubic foot.
Height of column, 96.31 inches.
Sectional area, 12".08 × 12".01 = 145.08 square inches.
Gauged length, 50".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
14,508	100	0.	0.	Initial load. Loaded with 12,000 pounds before testing.
21,762	150	.0015	.0005	
29,016	200	.0030	.0006	
36,270	250	.0048	.0010	
43,524	300	.0064	.0013	
50,778	350	.0080	.0017	
58,032	400	.0100	.0022	
65,286	450	.0123	.0028	
72,540	500	.0143	.0035	
79,794	550	.0169	.0043	
87,048	600	.0198	.0055	E (100-600) = 1,748,000 pounds per square inch.
.....	600	.0214	.0069	
94,302	650	.0245	.....	
101,556	700	.0275	.....	
108,810	750	.0304	.....	
116,064	800	.0372	.....	
121,000	834	.....	.....	Ultimate strength.

Column failed at the lower end. Pyramidal fragment developed.

No. 1773.

Neat cement column.
Plain column, without reënforcing metal.



Composition: Neat Alpha cement. Water, 24.5 per cent of cement.
Age, set in air, 10 months 25 days.
Weight of column, total, 607 pounds = 129.4 pounds per cubic foot.
Height of column, 96 inches.
Diameter of column, 10.37 inches.
Sectional area, 84.46 square inches.
Gauged length, 50".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
8,446	100	0.	0.	Initial load. Loaded with 7,000 pounds before testing.
12,669	150	.0015	.0004	
16,892	200	.0028	.0004	
21,115	250	.0039	.0006	
25,338	300	.0051	.0006	
29,561	350	.0063	.0007	
33,784	400	.0072	.0007	
38,007	450	.0083	.0007	
42,230	500	.0093	.0007	
46,453	550	.0102	.0008	
50,676	600	.0113	.0008	E (100–600) = 2,381,000 pounds per square inch.
.....	600	.0113	.0008	
54,899	650	.0119	.....	
59,122	700	.0130	.....	
63,345	750	.0139	.....	
67,568	800	.0149	.....	
71,791	850	.0158	.....	
76,014	900	.0166	.....	
80,237	950	.0175	.....	
84,460	1,000	.0182	.0011	E (600–1,000) = 3,030,000 pounds per square inch.
.....	600	.0115	.0011	
.....	600	.0117	.0011	
92,906	1,100	.0198	.....	
101,352	1,200	.0214	.....	
109,798	1,300	.0231	.....	
118,244	1,400	.0246	.....	
126,690	1,500	.0263	.0013	E (1,000–1,500) = 3,165,000 pounds per square inch.
.....	600	.0118	.0011	
.....	600	.0118	.0011	
135,136	1,600	.0275	.....	
143,582	1,700	.0293	.....	
152,028	1,800	.0308	.....	
160,474	1,900	.0326	.....	
168,920	2,000	.0343	.0013	E (1,500–2,000) = 3,125,000 pounds per square inch.

No. 1773—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
.....	600	.0120	.0013	
.....	600	.0110	.0004	Readings after resting half an hour under initial load. Temperature of the room lowered in the meantime.
177,366	2,100	.0348	.....	
185,812	2,200	.0363	.....	
194,258	2,300	.0380	.....	
202,704	2,400	.0397	.....	
211,150	2,500	.0414	.0010	E (2,000-2,500) = 3,378,000 pounds per square inch.
.....	600	.0116	.0010	
.....	600	.0115	.0010	
219,596	2,600	.0427	.....	
228,042	2,700	.0446	.....	
236,488	2,800	.0461	.....	
244,934	2,900	.0478	.....	
253,380	3,000	.0494	.0013	E (2,500-3,000) = 3,247,000 pounds per square inch.
.....	600	.0120	.0012	
.....	600	.0119	.0012	
261,826	3,100	.0507	.....	
270,272	3,200	.0525	.....	
278,718	3,300	.0542	.....	
287,164	3,400	.0560	.....	
295,610	3,500	.0579	.0018	E (3,000-3,500) = 3,125,000 pounds per square inch.
.....	600	.0124	.0015	
.....	600	.0121	.0014	
.....	500	.0100	.....	
.....	1,000	.0191	.....	
.....	1,500	.0267	.....	
.....	2,000	.0344	.....	
.....	2,500	.0421	.....	
.....	3,000	.0498	.....	
.....	2,500	.0424	.....	
.....	2,000	.0350	.....	
.....	1,500	.0274	.....	
.....	1,000	.0196	.....	
.....	500	.0107	.0015	
304,056	3,600	.0590	.....	
312,502	3,700	.0614	.....	
320,948	3,800	.0634	.....	
329,394	3,900	.0649	.....	
337,840	4,000	.0666	.0027	E (3,500-4,000) = 3,205,000 pounds per square inch.
.....	600	.0131	.0022	
.....	600	.0128	.0021	
346,286	4,100	.0677	.....	
354,732	4,200	.0696	.....	
363,178	4,300	.0714	.....	
371,624	4,400	.0735	.....	
380,070	4,500	.0751	.0033	E (4,000-4,500) = 3,165,000 pounds per square inch.
.....	600	0138	.0028	
.....	600	.0136	.0026	
388,516	4,600	.0768	.....	
396,962	4,700	.0889	.....	
405,408	4,800	.0807	.....	
413,854	4,900	.0827	.....	
422,300	5,000	.0845	.0039	E (4,500-5,000) = 2,841,000 pounds per square inch.

No. 1773—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
.....	600	.0145	.0035	
.....	600	.0144	.0034	
.....	.....	.....	.0026	After resting 15 minutes.
.....	1,000	.0204	.....	
.....	2,000	.0360	.....	
.....	3,000	.0517	.....	
.....	4,000	.0676	.....	
.....	3,000	.0528	.....	
.....	2,000	.0375	.....	
.....	1,000	.0216	.0034 .0031	After 3 minutes rest.
.....	.....	.....	.....	Micrometer removed.
591,220	7,000	.....	.....	Maximum load applied.

No appreciable injury done the column by the load of 7,000 pounds per square inch. Micrometer reapplied and reset at zero.

Observations renewed.

No. 1773—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
.....	100	0.	0.	Initial load.
.....	1,000	.0181	.....	
.....	2,000	.0338	.....	
.....	3,000	.0495	.....	
.....	4,000	.0656	.....	
.....	5,000	.0821	.....	
.....	6,000	.0985	.....	
.....	5,000	.0843	.....	
.....	4,000	.0683	.....	
.....	3,000	.0527	.....	
.....	2,000	.0365	.....	
.....	1,000	.0201	.0007	
.....	.....	.....	0.	Recovered to zero in 3 minutes.
20,000	.....	.....	.....	Column rested under this load 17 hours.
.....	100	.....	—.0006	
.....	1,000	.0169	.....	
.....	1,000	.0170	.....	After 3 minutes.
.....	2,000	.0325	.....	
.....	2,000	.0329	.....	Do.
.....	3,000	.0486	.....	
.....	3,000	.0489	.....	Do.
.....	4,000	.0646	.....	
.....	4,000	.0656	.....	Do.
.....	5,000	.0816	.....	
.....	5,000	.0822	.....	Do.
.....	6,000	.0984	.....	
.....	6,000	.1004	.....	Do.
.....	5,000	.0854	.....	
.....	5,000	.0853	.....	Do.
.....	4,000	.0702	.....	
.....	4,000	.0697	.....	Do.
.....	3,000	.0543	.....	
.....	3,000	.0540	.....	Do.
.....	2,000	.0384	.....	
.....	2,000	.0380	.....	Do.
.....	1,000	.0215	.....	
.....	1,000	.0211	.....	Do.
.....	100	.....	.0026	
.....	100	.....	.0020	After 3 minutes.
.....	100	.....	.0017	After 6 minutes.
.....	100	.....	0014	After 9 minutes.
.....	100	.....	.0013	After 12 minutes.
.....	100	.....	.0012	After 15 minutes.
.....	100	.....	.0010	After 25 minutes.
.....	1,000	.0184	.....	
.....	1,100	.0202	.....	
.....	1,200	.0218	.....	
.....	1,300	.0233	.....	
.....	1,400	.0251	.....	
.....	1,500	.0265	.....	
.....	1,400	.0251	.....	
.....	1,300	.0238	.....	
.....	1,200	.0223	.....	
.....	1,100	.0203	.....	
.....	1,000	.0189	.....	
.....	1,500	.0268	.....	
.....	1,000	.0191	.....	
.....	1,500	.0268	.....	

No. 1773—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
.....	1,000	.0191	.....	
.....	1,500	.0270	.....	
.....	1,000	.0190	.....	
.....	1,500	.0269	.....	
.....	1,000	.0193	.....	
.....	1,500	.0270	.....	
.....	2,000	.0347	.....	
.....	1,500	.0272	.....	
.....	2,000	.0347	.....	
.....	1,500	.0273	.....	
.....	2,000	.0347	.....	
.....	1,500	.0273	.....	
.....	2,000	.0348	.....	
.....	2,500	.0424	.....	
.....	2,000	.0350	.....	
.....	2,500	.0428	.....	
.....	2,000	.0351	.....	
.....	2,500	.0429	.....	
.....	2,000	.0353	.....	
.....	2,500	.0429	.....	
.....	3,000	.0508	.....	
.....	2,500	.0433	.....	
.....	3,000	.0510	.....	
.....	2,500	.0434	.....	
.....	3,000	.0510	.....	
.....	2,500	.0435	.....	
.....	2,000	.0359	.....	
.....	1,500	.0280	.....	
.....	1,000	.0201	.....	
.....	100	.....	.0020	
.....	.....	.....	.....	Rested under initial load 1 hour.
.....	100	.....	.0005	
.....	1,000	.0180	.....	
.....	1,500	.0260	.....	
.....	2,000	.0338	.....	
.....	2,500	.0418	.....	
.....	3,000	.0497	.....	
.....	3,500	.0579	.....	
.....	3,000	.0506	.....	
.....	3,500	.0587	.....	
.....	3,000	.0510	.....	
.....	3,500	.0587	.....	
.....	3,000	.0511	.....	
.....	3,100	.0528	.....	
.....	3,200	.0543	.....	
.....	3,300	.0560	.....	
.....	3,400	.0576	.....	
.....	3,500	.0591	.....	
.....	3,400	.0579	.....	
.....	3,300	.0565	.....	
.....	3,200	.0549	.....	
.....	3,100	.0534	.....	
.....	3,000	.0518	.....	
.....	3,100	.0533	.....	
.....	3,200	.0550	.....	
.....	3,300	.0567	.....	
.....	3,400	.0580	.....	
.....	3,500	.0595	.....	
.....	3,400	.0581	.....	
.....	3,300	.0568	.....	
.....	3,200	.0551	.....	
.....	3,100	.0538	.....	
.....	3,000	.0524	.....	
.....	2,000	.0371	.....	
.....	1,000	.0214	.....	
.....	100	.....	.0032	
.....	1,000	.0204	.....	
.....	2,000	.0360	.....	
.....	3,000	.0518	.....	
.....	4,000	.0675	.....	
.....	5,000	.0834	.....	
.....	6,000	.1000	.....	

No. 1773—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
.....	5,000	.0857	.....	
.....	4,000	.0705	.....	
.....	3,000	.0548	.....	
.....	2,000	.0390	.....	
.....	1,000	.0224	.....	
.....	100	.....	.0037	
.....	100	.....	.0028	After 5 minutes.
.....	100	.....	.0020	After 10 minutes.
.....	100	.....	.0018	After 15 minutes.

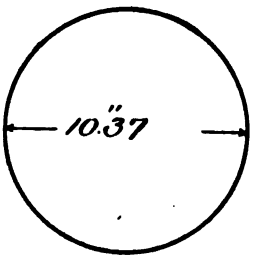
Test discontinued.

Column removed from the testing machine, its condition apparently having been unimpaired by the loads applied.

This column was exhibited at the Jamestown Ter-Centennial Exposition, 1907.

No. 1774.

1 : 1½ : 3 Mixture.
Plain column, without reënforcing metal.



Composition, by volume: Alpha cement, 1; sand (10-mesh sieve), 1½; trap rock (¼" to 1½"), 3. Water, 35.1 per cent of cement, by weight.
Age, set in air, 10 months 23 days.
Weight of column, total, 715 pounds.
Weight of concrete, 715 pounds = 152.1 pounds per cubic foot.
Height of column, 96.20 inches.
Diameter of column, 10.37 inches.
Sectional area, 84.46 square inches.
Gauged length, 50".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
8,446	100	0.	0.	Initial load. Loaded with 8,000 pounds before testing.
12,669	150	.0008	.0002	
16,892	200	.0013	.0004	
21,115	250	.0019	.0004	
25,338	300	.0024	.0004	
29,561	350	.0029	.0004	
33,784	400	.0035	.0005	
38,007	450	.0043	.0005	
42,230	500	.0046	.0006	
46,453	550	.0053	.0006	
50,676	600	.0058	.0008	E (100–600) = 5,000,000 pounds per square inch.
.....	600	.0059	.0009	
54,899	650	.0064	.....	
59,122	700	.0070	.....	
63,345	750	.0078	.....	
67,568	800	.0083	.....	
71,791	850	.0089	.....	
76,014	900	.0094	.....	
80,237	950	.0100	.....	
84,460	1,000	.0106	.0012	E (600–1,000) = 4,545,000 pounds per square inch.
.....	600	.0065	.0013	
.....	600	.0065	.0013	
92,906	1,100	.0120	.....	
101,352	1,200	.0132	.....	
109,798	1,300	.0145	.....	
118,244	1,400	.0160	.....	
126,690	1,500	.0174	.0021	E (1,000–1,500) = 4,237,000 pounds per square inch.

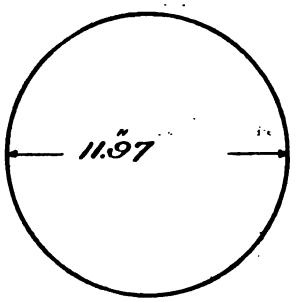
No. 1774—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
.....	600	.0074	.0021	
.....	600	.0074	.0021	
20,000	.....	.....	.....	Rested under this load 17 hours.
.....	600	.....	.0014	
135,136	1,600	.0183	.....	
143,582	1,700	.0195	.....	
152,028	1,800	.0210	.....	
160,474	1,900	.0224	.....	
168,920	2,000	.0239	.0030	E (1,500–2,000)=4,464,000 pounds per square inch.
.....	600	.0083	.0029	
.....	600	.0083	.0029	
177,366	2,100	.0256	.....	
185,812	2,200	.0275	.....	
194,258	2,300	.0289	.....	
202,704	2,400	.0306	.....	
211,150	2,500	.0323	.0049	E (2,000–2,500)=3,846,000 pounds per square inch.
.....	600	.0103	.0049	
.....	600	.0103	.0048	
219,596	2,600	.0344	.....	
228,042	2,700	.0364	.....	
236,488	2,800	.0380	.....	
244,934	2,900	.0402	.....	
253,380	3,000	.0423	.0075	E (2,500–3,000)=3,378,000 pounds per square inch.
.....	600	.0133	.0073	
.....	600	.0129	.0070	
261,826	3,100	.0468	.....	
270,272	3,200	.0488	.....	
278,718	3,300	.0520	.....	
287,164	3,400	.0548	.....	
295,610	3,500	.0584	.0140	E (3,000–3,500)=2,604,000 pounds per square inch.
.....	600	.0205	.0136	
.....	600	.0198	.0132	
302,000	3,576	.....	.....	Ultimate strength.

Column failed 3½ feet from lower end. Opened oblique and longitudinal cracks along a distance of 18″.

No. 1775.

1 : 2 : 4 Mixture.
Plain column, without reënforcing metal.



Composition, by volume: Alpha cement, 1; sand (10-mesh sieve), 2; trap rock ($\frac{1}{4}$″ to $1\frac{1}{2}$″), 4. Water, 52.6 per cent of cement.
Age, set in air, 10 months 22 days.
Weight of column, total, 954 pounds.
Weight of concrete, 954 pounds = 152.6 pounds per cubic foot.
Height of column, 96.05 inches.
Diameter of column, 11.97 inches.
Sectional area, 112.53 square inches.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
11,253	100	0.	0.	Initial load. Loaded with 8,000 pounds before testing.
16,880	150	.0005	0.	
22,506	200	.0010	0.	
28,133	250	.0015	.0001	
33,759	300	.0020	.0002	
39,386	350	.0029	.0003	
45,012	400	.0035	.0005	
50,639	450	.0042	.0005	
56,265	500	.0049	.0005	
61,892	550	.0056	.0007	
67,518	600	.0065	.0008	E (100–600) = 4,386,000 pounds per square inch.
.....	600	.0065	.0009	
73,145	650	.0073	.....	
78,771	700	.0083	.....	
84,398	750	.0089	.....	
90,024	800	.0096	.....	
95,651	850	.0105	.....	
101,277	900	.0114	.....	
106,904	950	.0123	.....	
112,530	1,000	.0130	.0019	E (600–1,000) = 3,704,000 pounds per square inch.
.....	600	.0080	.0019	
.....	600	.0080	.0019	
123,783	1,100	.0148	.....	
135,036	1,200	.0166	.....	
146,289	1,300	.0188	.....	
157,542	1,400	.0206	.....	
168,795	1,500	.0228	.0039	E (1,000–1,500) = 3,205,000 pounds per square inch.

No. 1775—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
.....	600	.0105	.0039	
.....	600	.0105	.0039	
180,048	1,600	.0250	.....	
191,301	1,700	.0278	.....	
202,554	1,800	.0303	.....	
213,807	1,900	.0325	.....	
225,060	2,000	.0353	.0076	E (1,500-2,000)=2,841,000 pounds per square inch.
.....	600	.0149	.0076	
.....	600	.0149	.0076	
236,313	2,100	.0396	.....	
247,566	2,200	.0425	.....	
258,819	2,300	.0472	.....	
270,072	2,400	.0535	.0155	Ultimate strength.
.....	600	.0244	.0155	
.....	600	.0244	.0154	

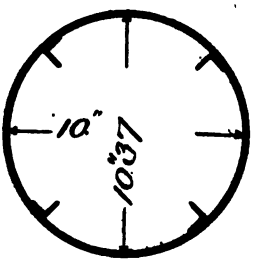
Column failed upon reapplication of load, after determining sets under initial load, the highest load then reached being about 265,000 pounds total.

Oblique and longitudinal cracks opened in lower part of column, ranging from 2 to 3 feet from the bottom.

No. 1750.

1 : 1 Mortar.

Reënforced with 48 hoops, each 1″.04 wide by ″.06 thick, and four 1″×1″ by 95″.80 steel angle bars. Hoops spaced 2″ apart, center to center.



Composition, by volume: Alpha cement, 1; sand (10-mesh sieve), 1. Water, 32 per cent of cement, by weight.
Age, set in air, 1 year 5 days.
Weight of column, total, 660 pounds.
Weight of concrete, 599 pounds = 131.4 pounds per cubic foot.
Weight of cage, complete, 61 pounds.
Height of column, 95.80 inches.
Diameter of column, 10.37 inches.
Sectional area, gross, 84.46 square inches.
Sectional area of angle bars, 0.91 square inch.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
8,446	100	0.	0.	Initial load. Column loaded with 6,000 pounds before testing.
12,669	150	.0034	.0008	
16,892	200	.0068	.0013	
21,115	250	.0094	.0016	
25,338	300	.0114	.0017	
29,561	350	.0133	.0017	
33,784	400	.0147	.0017	
38,008	450	.0161	.0018	
42,230	500	.0175	.0018	
46,453	550	.0185	.0019	
50,676	600	.0198	.0019	E (100–600) = 1,397,000 pounds per square inch.
.....	600	.0198	.0019	
54,899	650	.0212	.0020	
59,122	700	.0223	.0020	
63,345	750	.0233	.0020	
67,568	800	.0243	.0021	
71,791	850	.0254	.0022	
76,014	900	.0265	.0022	
80,237	950	.0276	.0023	
84,460	1,000	.0285	.0023	E (600–1,000) = 2,410,000 pounds per square inch.
.....	600	.0217	.0023	
.....	600	.0216	.0023	
92,906	1,100	.0303	.....	
101,352	1,200	.0322	.....	
109,798	1,300	.0343	.....	
118,244	1,400	.0359	.....	
126,690	1,500	.0378	.0028	E (1,000–1,500) = 2,841,000 pounds per square inch.

No. 1750—Continued.

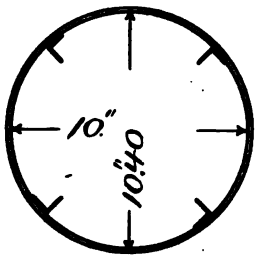
Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
.....	600	.0225	.0028	
.....	600	.0225	.0028	
135,136	1,600	.0397	.....	
143,582	1,700	.0414	.....	
152,028	1,800	.0432	.....	
160,474	1,900	.0450	.....	
168,920	2,000	.0467	.0037	E (1,500-2,000)=3,125,000 pounds per square inch.
.....	600	.0235	.0035	
.....	600	.0234	.0035	
177,366	2,100	.0483	.....	
185,812	2,200	.0500	.....	
194,258	2,300	.0517	.....	
202,704	2,400	.0535	.....	
211,150	2,500	.0554	.....	
219,596	2,600	.0572	.....	
228,042	2,700	.0590	.....	
236,488	2,800	.0609	.....	
244,934	2,900	.0627	.....	
253,380	3,000	.0647	.0082	E (2,000-3,000)=3,704,000 pounds per square inch.
.....	600	.0263	.0081	
.....	600	.0261	.0081	
261,826	3,100	.0669	.....	
270,272	3,200	.0689	.....	
278,718	3,300	.0710	.....	
287,164	3,400	.0731	.....	
295,610	3,500	.0752	.....	
304,056	3,600	.0774	.....	
312,502	3,700	.0793	.....	
320,948	3,800	.0820	.....	
329,394	3,900	.0839	.....	
337,840	4,000	.0861	.0207	E (3,000-4,000)=5,618,000 pounds per square inch.
.....	600	.0318	.0208	
.....	600	.0317	.0208	
346,286	4,100	.0881	.....	
354,732	4,200	.0907	.....	
363,178	4,300	.0930	.....	
371,624	4,400	.0953	.....	
380,070	4,500	.0978	.0260	E (4,000-4,500)=3,906,000 pounds per square inch.
.....	600	.0362	.0258	
.....	600	.0360	.0255	
388,516	4,600	.0996	.....	
396,962	4,700	.1027	.....	
405,408	4,800	.1059	.....	
413,854	4,900	.1081	.....	
422,300	5,000	.1111	.0317	E (4,500-5,000)=3,289,000 pounds per square inch.
.....	600	.0409	.0310	
.....	600	.0406	.0308	
520,000	6,157	.....	.....	Ultimate strength.

Metal crushed at upper end of column, 10″ to 20″ from top.

No. 1748.

1 : 1 : 2 Mixture.

Reënforced with 48 hoops, each 1″.04 wide by ″.06 thick, and four 1″ × 1″ by 95″.85 steel angle bars. Hoops spaced 2″ apart, center to center.



Composition, by volume: Alpha cement, 1; sand (10-mesh sieve), 1; trap rock ($\frac{1}{4}$″ to $\frac{3}{4}$″), 2. Water, 35 per cent of cement, by weight.
Age, set in air, 1 year 3 days.
Weight of column, total, 735.5 pounds.
Weight of concrete, 674.5 pounds = 146.9 pounds per cubic foot.
Weight of cage, complete, 61 pounds.
Height of column, 95.85 inches.
Diameter of column, 10.40 inches.
Sectional area, gross, 84.95 square inches.
Sectional area of angle bars, 0.91 square inch.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
8,495	100	0.	0.	Initial load. Loaded with 17,000 pounds before testing.
12,743	150	.0006	0.	
16,990	200	.0012	.0001	
21,238	250	.0018	.0002	
25,485	300	.0023	.0002	
29,733	350	.0028	.0003	
33,980	400	.0034	.0003	
38,228	450	.0042	.0004	
42,475	500	.0049	.0005	
46,723	550	.0055	.0005	
50,970	600	.0063	.0006	E (100–600) = 4,386,000 pounds per square inch.
.....	600	.0063	.0007	Rested under 15,000 pounds 40 hours.
.....	100	.....	.0005	
55,218	650	.0068	.0005	
59,465	700	.0076	.0006	
63,713	750	.0082	.0007	
67,960	800	.0091	.0007	
72,208	850	.0096	.0008	
76,455	900	.0103	.0009	
80,703	950	.0111	.0010	
84,950	1,000	.0118	.0010	E (600–1,000) = 3,922,000 pounds per square inch.
.....	600	.0070	.0012	
.....	600	.0070	.0012	
93,445	1,100	.0133	.0013	
101,940	1,200	.0145	.0014	
110,435	1,300	.0160	.0015	
118,930	1,400	.0173	.0016	
127,425	1,500	.0186	.0016	E (1,000–1,500) = 4,032,000 pounds per square inch.
.....	600	.0078	.0017	
.....	600	.0078	.0017	

No. 1748—Continued.

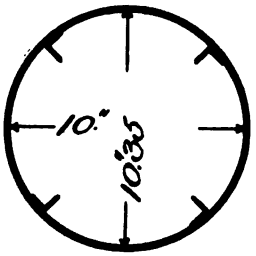
Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
135,920	1,600	.0199	.....	
144,415	1,700	.0217	.....	
152,910	1,800	.0230	.....	
161,405	1,900	.0244	.....	
169,900	2,000	.0260	.0024	E (1,500-2,000)=3,788,000 pounds per square inch.
.....	600	.0088	.0025	
.....	600	.0088	.0025	
178,395	2,100	.0277	.....	
186,890	2,200	.0290	.....	
195,385	2,300	.0305	.....	
203,880	2,400	.0324	.....	
212,375	2,500	.0338	.0038	E (2,000-2,500)=3,906,000 pounds per square inch.
.....	600	.0100	.0034	
.....	600	.0100	.0034	
220,870	2,600	.0358	.....	
229,365	2,700	.0374	.....	
237,860	2,800	.0392	.....	
246,355	2,900	.0412	.....	
254,850	3,000	.0434	.0056	E (2,500-3,000)=3,205,000 pounds per square inch.
.....	600	.0121	.0053	
.....	600	.0119	.0053	
263,345	3,100	.0450	.....	
271,840	3,200	.0473	.....	
280,335	3,300	.0493	.....	
288,830	3,400	.0513	.....	
297,325	3,500	.0535	.0078	E (3,000-3,500)=3,165,000 pounds per square inch.
.....	600	.0143	.0073	
.....	600	.0143	.0073	
305,820	3,600	.0566	.....	
314,315	3,700	.0594	.....	
322,810	3,800	.0617	.....	
331,305	3,900	.0642	.....	
339,800	4,000	.0670	.0121	E (3,500-4,000)=2,717,000 pounds per square inch.
.....	600	.0196	.0120	
.....	600	.0193	.0118	
348,295	4,100	.0715	.....	
356,790	4,200	.0750	.....	
365,285	4,300	.0781	.....	
373,780	4,400	.0820	.....	
382,275	4,500	.0857	.0207	E (4,000-4,500)=2,475,000 pounds per square inch.
.....	600	.0284	.0201	
.....	600	.0282	.0199	
390,770	4,600	.0919	.....	
399,265	4,700	.0966	.....	
407,760	4,800	.1003	.....	
416,255	4,900	.1048	.....	
424,750	5,000	.1095	.0334	E (4,500-5,000)=2,252,000 pounds per square inch.
.....	600	.0412	.0325	
.....	600	.0401	.0325	
479,000	5,639	.....	.....	Ultimate strength.

Column failed in the upper half of its height; the concrete was disintegrated. Loads were continued after reaching the maximum until the resistance of the column had dropped to 430,000 pounds.

No. 1751.

1 : 4 Mortar.

Reënforced with 48 hoops, each 1″.04 wide by ″.06 thick, and four 1″×1″ by 95″.60 steel angle bars. Hoops spaced 2″ apart, center to center.



Composition, by volume: Alpha cement, 1; sand (10-mesh sieve), 4. Water, 55.8 per cent of cement, by weight.
Age, set in air, 1 year 4 days.
Weight of column, total, 602 pounds.
Weight of concrete, 541 pounds = 119.4 pounds per cubic foot.
Weight of cage, complete, 61 pounds.
Height of column, 95.60 inches.
Diameter of column, 10.35 inches.
Sectional area, gross, 84.13 square inches.
Sectional area of angle bars, 0.91 square inch.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
8,413	100	0.	0.	Initial load; loaded with 8,000 pounds before testing.
12,620	150	.0024	.0005	
16,826	200	.0052	.0009	
21,033	250	.0081	.0013	
25,239	300	.0104	.0016	
29,446	350	.0131	.0020	
33,652	400	.0156	.0022	
37,859	450	.0182	.0025	
42,065	500	.0208	.0028	
46,272	550	.0233	.0030	
50,478	600	.0256	.0034	E (100-600) = 1,126,000 pounds per square inch.
.....	600	.0258	.0034	
54,685	650	.0280	.0036	
58,891	700	.0303	.0039	
63,098	750	.0326	.0043	
67,304	800	.0349	.0045	
71,511	850	.0372	.0047	
75,717	900	.0394	.0048	
79,924	950	.0419	.0051	
84,130	1,000	.0443	.0054	E (600-1,000) = 1,198,000 pounds per square inch.
.....	600	.0303	.0053	
.....	600	.0302	.0050	
92,543	1,100	.0488	.0059	
100,956	1,200	.0539	.0065	
109,369	1,300	.0598	.0078	
117,782	1,400	.0658	.0096	
126,195	1,500	.0731	.0125	E (1,000-1,500) = 1,152,000 pounds per square inch.

No. 1751—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
.....	600	.0402	.0125	
.....	600	.0402	.0124	
.....	.....	.....	.....	Rested under 20,000 pounds 16 hours.
.....	100	.....	.0135	
.....	600	.0406	.0136	
.....	600	.0406	.0136	
134,608	1,600	.0823	.0174	
143,021	1,700	.0940	.0265	
151,434	1,800	.1090	.0389	
159,847	1,900	.1263	.0536	
168,260	2,000	.1411	.0595	E (1,500-2,000)=1,190,000 pounds per square inch.
.....	600	.0833	.0589	
.....	600	.0828	.0585	
176,673	2,100	.1544	.0656	
185,086	2,200	.1632	.0771	
.....	2,200	.1690	.0824	
193,499	2,300	.1856	.0952	
201,912	2,400	.2009	.1024	
210,325	2,500	.2190	.1207	E (2,000-2,500)=1,497,000 pounds per square inch.
.....	600	.1435	.1206	
.....	600	.1430	.1205	
233,000	2,770	.....	.....	Ultimate strength.

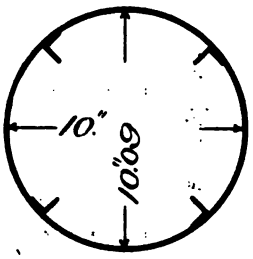
Two hoops near middle of length of column fractured at time of reaching the maximum load.

Cracks generally developed between the hoops, making their appearance at 1,500 to 1,800 pounds per square inch loads and increasing in number as the test advanced. The mortar was disintegrated in the vicinity of one of the contact points of the micrometer, hence the readings during the latter part of the test were modified thereby.

No. 1749.

1 : 4 : 8 Mixture.

Reënforced with 48 hoops, each 1″.04 wide by ″.06 thick, and four 1″×1″ by 95″.80 steel angle bars. Hoops spaced 2″ apart, center to center.



Composition, by volume: Alpha cement, 1; sand (10-mesh sieve), 4; trap rock (¼″ to ¾″), 8. Water, 87.4 per cent of cement, by weight.

Age, set in air, 1 year 4 days.

Weight of column, total, 682 pounds.

Weight of concrete, 621 pounds = 144.4 pounds per cubic foot.

Weight of cage, complete, 61 pounds. Height of column, 95.80 inches.

Diameter of column, 10″.09 inches.

Sectional area, gross, 79.88 square inches.

Sectional area of angle bars, 0.91 square inch.

Gauged length, 50″.

Applied loads.		In guaged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
7,988	100	0.	0.	Initial load. Loaded with 8,000 pounds before testing.
11,982	150	.0035	.0010	
15,976	200	.0064	.0014	
19,970	250	.0091	.0016	
23,964	300	.0115	.0018	
27,958	350	.0141	.0022	
31,952	400	.0164	.0024	
35,946	450	.0189	.0026	
39,940	500	.0214	.0029	
43,934	550	.0235	.0030	
47,928	600	.0260	.0034	E (100–600) = 1,106,000 pounds per square inch.
.....	600	.0262	.0034	
51,922	650	.0283	.0036	
55,916	700	.0307	.0037	
59,910	750	.0331	.0038	
63,904	800	.0357	.0041	
67,898	850	.0385	.0045	
71,892	900	.0408	.0049	
75,886	950	.0437	.0053	
79,880	1,000	.0464	.0053	E (600–1,000) = 1,081,000 pounds per square inch.
.....	600	.0346	.0053	
.....	600	.0345	.0052	
87,868	1,100	.0518	.0061	
95,856	1,200	.0581	.0074	
103,844	1,300	.0654	.0098	
111,832	1,400	.0736	.0135	
119,820	1,500	.0838	.0199	E (1,000–1,500) = 1,096,000 pounds per square inch.

No. 1749—Continued.

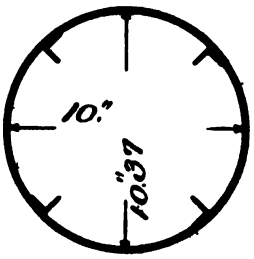
Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
.....	600	.0544	.0201	
.....	600	.0541	.0199	
127,808	1,600	.0939	.0286	
135,796	1,700	.1065	.0398	
143,784	1,800	.1195	.0508	
151,772	1,900	.1345	.0636	
159,760	2,000	.1480	.0754	E (1,500-2,000)=2,874,000 pounds per square inch.
.....	600	.1015	.0751	
.....	600	.1012	.0752	
167,748	2,100	.1628	.0872	
175,736	2,200	.1758	.0980	
183,724	2,300	.1897	.1102	
191,712	2,400	.2039	.1219	
199,700	2,500	.2130	.1297	E (2,000-2,500)=2,836,000 pounds per square inch.
.....	600	.1514	.1297	
.....	600	.1508	.1295	
215,000	2,692	.....	.....	Ultimate strength.

Fractured seventh hoop from upper end of column at time of reaching the maximum load.

No. 1757.

1 : 2 : 4 Mixture.

Reënforced with four 1″×1″ by 95″.45 steel angle bars, which were retained in position by two hoops, each 1″.04 wide by ″.06 thick, one at each end of the column.



Composition, by volume: Alpha cement, 1; sand (10-mesh sieve), 2; trap rock (¼″ to 1½″), 4. Water, 52.4 per cent of cement, by weight.

Age, set in air, 11 months 24 days.

Weight of column, total, 712 pounds.

Weight of concrete, 684 pounds = 148.4 pounds per cubic foot.

Weight of cage, complete, 28 pounds.

Height of column, 95.45 inches.

Diameter of column, 10.37 inches.

Sectional area, gross, 84.46 square inches.

Sectional area of angle bars, 0.91 square inch.

Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
8,446	100	0.	0.	Initial load. Loaded with 9,000 pounds before testing.
12,669	150	.0014	.0004	
16,892	200	.0030	.0006	
21,115	250	.0045	.0008	
25,338	300	.0062	.0010	
29,561	350	.0076	.0011	
33,784	400	.0094	.0013	
38,007	450	.0109	.0016	
42,230	500	.0124	.0019	
46,453	550	.0141	.0022	
50,676	600	.0157	.0024	E (100–600) = 1,880,000 pounds per square inch.
.....	600	.0158	.0026	
54,899	650	.0174	.0029	
59,122	700	.0188	.0030	
63,345	750	.0204	.0032	
67,568	800	.0220	.0037	
71,791	850	.0236	.0039	
76,014	900	.0251	.0043	
80,237	950	.0267	.0045	
84,460	1,000	.0282	.0046	E (600–1,000) = 1,942,000 pounds per square inch.
.....	600	.0207	.0048	
.....	600	.0199	.0039	
.....	.....	.....	.0038	Set after resting 40 minutes.

No. 1757—Continued.

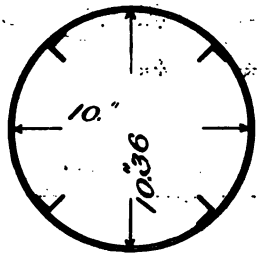
Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
92,906	1,100	.0310	.0046	
101,352	1,200	.0345	.0053	
109,798	1,300	.0384	.0058	
118,244	1,400	.0424	.0069	
126,690	1,500	.0471	.0066	E (1,000-1,500)=1,479,000 pounds per square inch.
.....	600	.0284	.0066	
.....	600	.0283	.0066	
133,800	1,584	.....	.....	Ultimate strength.

Column failed 15″ from the lower end. Loads were continued until the angles buckled locally, which occurred at the place of failure of the concrete.

No. 1758.

1 : 2 : 4 Mixture.

Reënforced with 2 hoops, each 1″.04 wide by ″.06 thick, and four 1″×1″ by 95″.80 steel angle bars. There were seven hoops used during the construction of this column, five of which were sawed apart prior to testing, leaving the two end ones only intact. The hoops were annealed before making up the reënforcing cage. When sawed apart after the construction of the column they gave no evidence of having been under initial tension in the completed column.



Composition, by volume: Alpha cement, 1; sand (10-mesh sieve), 2; trap rock (¾″ to 1½″), 4. Water, 56.8 per cent of cement by weight.

Age, set in air, 11 months 20 days.

Weight of column, total, 702 pounds.

Weight of concrete, 670.5 pounds = 145.4 pounds per cubic foot.

Weight of cage, complete, 31½ pounds.

Height of column, 95.80 inches.

Diameter of column, 10.36 inches.

Sectional area, gross, 84.30 square inches.

Sectional area of angle bars, 0.91 square inch.

Gauged length, 50″.

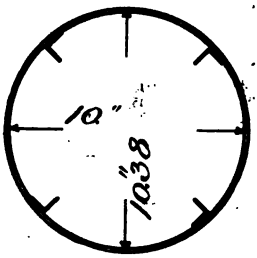
Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
8,430	100	0.	0.	Initial load. Loaded with 7,000 pounds before testing.
12,645	150	.0018	.....	
16,860	200	.0037	.....	
21,075	250	.0056	.....	
25,290	300	.0076	.....	
29,505	350	.0096	.....	
33,720	400	.0114	.....	
37,935	450	.0133	.....	
42,150	500	.0153	.....	
46,365	550	.0173	.....	
50,580	600	.0189	.0037	
54,795	650	.0209	.....	
59,010	700	.0224	.....	
63,225	750	.0245	.....	
67,440	800	.0266	.....	
71,655	850	.0284	.....	
75,870	900	.0304	.....	
80,085	950	.0323	.....	
84,300	1,000	.0345	.0063	
92,730	1,100	.0394	.....	
101,160	1,200	.0436	.....	
109,590	1,300	.0483	.....	
118,020	1,400	.0543	.....	
126,450	1,500	.0626	.0138	
140,000	1,661	.....	.....	Ultimate strength.

Column failed 30″ from lower end.

No. 1756.

1 : 2 : 4 Mixture.

Reënforced with 5 hoops, each 1″.04 wide by ″.06 thick, and four 1″×1″ by 95″.65 steel angle bars. Hoops spaced about 24″ apart, center to center.



Composition, by volume: Alpha cement, 1; sand (10-mesh sieve), 2; trap rock (¾″ to 1½″), 4. Water, 52.4 per cent of cement by weight.

Age, set in air, 11 months 25 days.

Weight of column, total, 719 pounds.

Weight of concrete, 689 pounds = 149.1 pounds per cubic foot.

Weight of cage, complete, 30 pounds.

Height of column, 95.65 inches.

Diameter of column, 10.38 inches.

Sectional area, gross, 84.62 square inches.

Sectional area of angle bars, 0.91 square inch.

Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
8,462	100	0.	0.	Initial load. Loaded with 7,000 pounds before testing.
12,693	150	.0015	.0004	
16,924	200	.0033	.0007	
21,155	250	.0049	.0008	
25,386	300	.0065	.0011	
29,617	350	.0084	.0014	
33,848	400	.0100	.0015	
38,079	450	.0118	.0019	
42,310	500	.0133	.0020	
46,541	550	.0148	.0022	
50,772	600	.0168	.0026	E (100-600)=1,761,000 pounds per square inch.
.....	600	.0169	.0026	
55,003	650	.0185	.0029	
59,234	700	.0201	.0030	
63,465	750	.0218	.0033	
67,696	800	.0235	.0036	
71,924	850	.0253	.0040	
76,158	900	.0272	.0041	
80,389	950	.0290	.0043	
84,620	1,000	.0314	.0047	E (600-1,000)=1,600,000 pounds per square inch.
.....	600	.0229	.0047	
.....	600	.0230	.0047	

No. 1756—Continued.

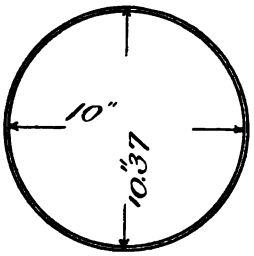
Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
93,082	1,100	.0350	.0050	
101,544	1,200	.0394	.0058	
110,006	1,300	.0434	.0066	
118,468	1,400	.0503	.0082	
126,930	1,500	.0603	.0121	E (1,000–1,500)=1,163,000 pounds per square inch.
.....	600	.0385	.0122	
.....	600	.0387	.0122	
135,392	1,600	.....	.....	Ultimate strength.

Column failed 3″ from upper end. The concrete in this vicinity appeared, locally, leaner than the average mixture. Loads were continued after passing the maximum, the column continuing to yield in the meantime. The angle bars eventually buckled outward at the place of failure of the column.

No. 1754.

1:2: 4 Mixture.

Reënforced with 24 hoops, each 1″.04 wide by ″.06 thick, spaced about 4″ apart, center to center. Hoops held in position during construction by means of fine wires attached to the mold.



Composition, by volume: Alpha cement, 1; sand (10-mesh sieve), 2; trap rock (¾″ to 1½″), 4. Water, 52.4 per cent of cement by weight.

Age, set in air, 11 months 23 days.

Weight of column, total, 706 pounds.

Weight of concrete, 689 pounds = 147.9 pounds per cubic foot.

Weight of hoops, 17 pounds.

Height of column, 96.10 inches.

Diameter of column, 10.37 inches.

Sectional area, gross, 84.46 square inches.

No vertical bars used.

Gauged length, 50″.

Column defective on account of displacement of hoops.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
8,446	100	0.	0.	Initial load. Loaded with 6,000 pounds before testing.
12,669	150	.0011	.0003	
16,892	200	.0021	.0005	
21,115	250	.0033	.0009	
25,338	300	.0045	.0011	
29,561	350	.0058	.0013	
33,784	400	.0073	.0019	
38,007	450	.0085	.0022	
42,230	500	.0098	.0027	
46,453	550	.0113	.0031	
50,676	600	.0129	.0038	E (100–600)=2,747,000 pounds per square inch.
.....	600	.0133	.0038	
54,899	650	.0147	.0044	
59,122	700	.0161	.0048	
63,345	750	.0179	.0056	
67,568	800	.0198	.0063	
71,791	850	.0218	.0070	
76,014	900	.0238	.0080	
80,237	950	.0260	.0090	
84,460	1,000	.0283	.0100	E (600–1,000)=2,174,000 pounds per square inch.
.....	600	.0209	.0100	
.....	600	.0209	.0102	
.....	.....	.....	.0097	Set after resting half an hour.

No. 1754—Continued.

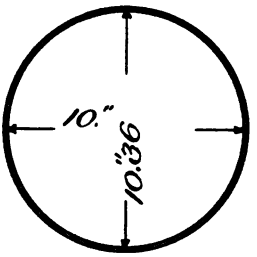
Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
92,906	1,100	.0338	.0129	
101,352	1,200	.0397	.0161	
109,798	1,300	.0475	.0208	
118,244	1,400	.0559	.0258	
126,690	1,500	.0658	.0316	E (1,000–1,500)=1,572,000 pounds per square inch.
.....	600	.0458	.0317	
.....	600	.0457	.0317	
135,136	1,600	.0779	.0394	
143,582	1,700	.0915	.0479	
152,028	1,800	.1047	.0570	
160,474	1,900	.1209	.0671	
168,920	2,000	.1415	.0814	E (1,500–2,000)=965,000 pounds per square inch.
.....	600	.1014	.0810	
.....	600	.1011	.0811	
177,366	2,100	.1645	.0973	Snapping sounds.
185,812	2,200	.1945	.1193	
186,000	2,206	.....	.....	Ultimate strength.

Column failed 30″ from lower end. At this place one of the hoops was displaced during construction. It made an angle of about 80° with the axis of the column.

No. 1752.

1 : 2 : 4 Mixture.

Reënforced with 48 hoops, each 1″.04 wide by ″.06 thick, spaced 2″ apart, center to center. Hoops held in position during construction by means of fine wires attached to the mold.



Composition, by volume: Alpha cement, 1; sand (10-mesh sieve), 2; trap rock (¾″ to 1½″), 4. Water, 52.4 per cent of cement, by weight.
Age, set in air, 1 year.
Weight of column, total, 728 pounds.
Weight of concrete, 694.25 pounds = 150.3 pounds per cubic foot.
Weight of hoops, 33.75 pounds.
Height of column, 96.20 inches.
Diameter of column, 10.36 inches.
Sectional area, gross, 84.30 square inches.
No vertical bars used.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
8,430	100	0.	0.	Initial load. Loaded with 6,000 pounds before testing.
12,645	150	.0008	.0002	
16,860	200	.0016	.0003	
21,075	250	.0023	.0004	
25,290	300	.0033	.0005	
29,505	350	.0042	.0006	
33,720	400	.0052	.0007	
37,935	450	.0061	.0010	
42,150	500	.0074	.0011	
46,365	550	.0085	.0013	
50,580	600	.0097	.0017	E (100-600) = 3,125,000 pounds per square inch.
.....	600	.0097	.0019	
54,795	650	.0108	.0020	
59,010	700	.0119	.0023	
63,225	750	.0133	.0027	
67,440	800	.0144	.0031	
71,655	850	.0159	.0035	
75,870	900	.0171	.0038	
80,085	950	.0186	.0041	
84,300	1,000	.0202	.0048	(600-1,000) = 2,703,000 pounds per square inch.
.....	600	.0137	.0047	
.....	600	.0137	.0047	
92,730	1,100	.0228	.0056	
101,160	1,200	.0265	.0071	
109,590	1,300	.0294	.0083	
118,020	1,400	.0331	.0097	
126,450	1,500	.0379	.0120	E (1,000-1,500) = 2,381,000 pounds per square inch. Snapping sound.

No. 1752—Continued.

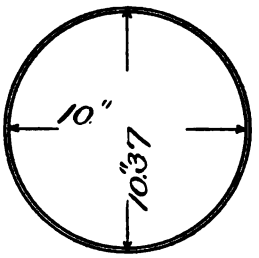
Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
.....	600	.0222	.0120	
.....	600	.0220	.0118	
134,880	1,600	.0426	.0143	
143,310	1,700	.0470	.0163	
151,740	1,800	.0526	.0193	
160,170	1,900	.0576	.0216	
168,600	2,000	.0640	.0250	E (1,500-2,000) = 1,908,000 pounds per square inch.
.....	600	.0373	.0250	
.....	600	.0371	.0250	
177,030	2,100	.0713	.0289	
185,460	2,200	.0781	.0331	
193,890	2,300	.0851	.0363	
202,320	2,400	.0928	.0413	
210,750	2,500	.1005	.0447	E (2,000-2,500) = 1,488,000 pounds per square inch.
.....	600	.0589	.0447	
.....	600	.0589	.0447	
219,180	2,600	.1087	.0507	
.....	.....	.....	.0479	Set after resting half an hour.
227,610	2,700	.1188	.0564	
236,040	2,800	.1288	.0624	
244,470	2,900	.1400	.0692	
252,900	3,000	.1523	.0781	E (2,500-3,000) = 1,359,000 pounds per square inch.
.....	600	.0942	.0778	
.....	600	.0935	.0775	
261,330	3,100	.1625	.0847	
262,000	3,108	.....	.....	Ultimate strength.

Column failed 15″ from the lower end. When the column was under the maximum load one hoop fractured. There was a displaced hoop in the section of the column which failed. The hoop was in a plane making an angle of about 75° with the axis of the column.

No. 1753.

1:3:6 Mixture.

Reënforced with 48 hoops, each 1″.04 wide by ″.06 thick, spaced 2″ apart, center to center. Hoops held in position during construction by means of fine wires attached to the mold.



Composition, by volume: Alpha cement, 1; sand (10-mesh sieve), 3; trap rock (¾″ to 1½″), 6. Water, 75 per cent of cement, by weight.
Age, set in air, 11 months 24 days.
Weight of column, total, 718 pounds.
Weight of concrete, 684 pounds = 147.7 pounds per cubic foot.
Weight of hoops, 34 pounds.
Height of column, 96.10 inches.
Diameter of column, 10.37 inches.
Sectional area, gross, 84.46 square inches.
No vertical bars used.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
8,446	100	0.	0.	Initial load. Loaded with 8,000 pounds before testing.
12,669	150	.0010	0.	
16,892	200	.0021	.0004	
21,115	250	.0034	.0008	
25,338	300	.0050	.0011	
29,561	350	.0064	.0016	
33,784	400	.0078	.0019	
38,007	450	.0096	.0027	
42,230	500	.0116	.0033	
46,453	550	.0138	.0041	
50,676	600	.0158	.0051	E (100–600) = 2,336,000 pounds per square inch.
.....	600	.0163	.0056	
54,899	650	.0185	.0063	
59,122	700	.0207	.0073	
63,345	750	.0233	.0085	
67,568	800	.0266	.0100	
71,791	850	.0298	.0117	
76,014	900	.0328	.0134	
80,237	950	.0368	.0153	
84,460	1,000	.0410	.0180	E (600–1,000) = 1,626,000 pounds per square inch.
.....	600	.0319	.0180	
.....	600	.0318	.0180	
92,906	1,100	.0503	.0232	
101,352	1,200	.0603	.0292	
109,798	1,300	.0703	.0354	
118,244	1,400	.0824	.0432	
126,690	1,500	.0963	.0525	E (1,000–1,500) = 1,202,000 pounds per square inch.

No. 1753—Continued.

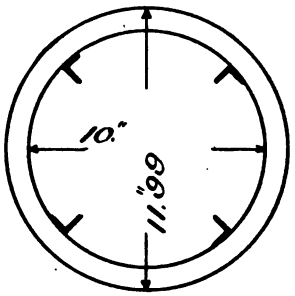
Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
.....	600	.0708	.0525	
.....	600	.0706	.0524	
135,136	1,600	.1120	.0626	
143,582	1,700	.1258	.0724	
152,028	1,800	.1423	.0832	
160,474	1,900	.1586	.0947	
168,920	2,000	.1768	.1070	E (1,500-2,000)=962,000 pounds per square inch.
.....	600	.1309	.1072	
.....	600	.1303	.1073	
177,366	2,100	.1983	.1223	
185,812	2,200	.2195	.1390	
194,258	2,300	.2433	.1554	
.....	600	.1822	.1559	
.....	600	.1816	.1560	
.....	200	.1590	.....	
.....	400	.1700	.....	
.....	600	.1800	.....	
.....	800	.1898	.....	
.....	1,000	.1985	.....	
.....	800	.1940	.....	
.....	600	.1876	.....	
.....	400	.1786	.....	
.....	200	.1646	.1561	
202,704	2,400	.2658	.1744	
211,150	2,500	.2872	.1972	E (2,000-2,500)=1,238,000 pounds per square inch.
.....	600	.2259	.1973	
.....	600	.2256	.1976	
232,300	2,750	.....	.....	Ultimate strength.

Column failed near middle of its height.
Two hoops fractured at time of reaching the maximum load.

No. 1765.

1 : 3 : 6 Mixture.

Reënforced with 25 hoops, each 1″.50 wide by ″.12 thick, and four 1″×1″ by 95″.95 steel angle bars. Hoops spaced 4″ apart, center to center. Concrete shell outside of reënforcement.



Composition, by volume: Alpha cement, 1; sand (10-mesh sieve), 3; trap rock (¾″ to 1½″), 6. Water, 69.9 per cent of cement, by weight.

Age, set in air, 1 year 2 months 14 days.

Weight of column, total, 980 pounds.

Weight of concrete, 908 pounds = 148.4 pounds per cubic foot.

Weight of cage, complete, 72 pounds.

Height of column, 95.95 inches.

Diameter of column, 11.99 inches.

Sectional area, gross, 112.91 square inches.

Sectional area of angle bars, 0.91 square inch.

Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
11,291	100	0.	0.	Initial load. Loaded with 8,000 pounds before testing.
16,937	150	.0041	.0016	
22,582	200	.0081	.0030	
28,228	250	.0118	.0041	
33,873	300	.0153	.0051	
39,519	350	.0192	.0061	
45,164	400	.0228	.0070	
50,810	450	.0264	.0078	
56,455	500	.0302	.0087	
62,101	550	.0340	.0093	
67,746	600	.0379	.0100	E (100-600) = 896,000 pounds per square inch.
.....	600	.0389	.0104	
73,392	650	.0426	.0110	
79,037	700	.0467	.0119	
84,683	750	.0514	.0133	
90,328	800	.0559	.0147	
95,974	850	.0622	.0176	
101,619	900	.0678	.0209	
107,265	950	.0740	.0248	
112,910	1,000	.0810	.0301	E (600-1,000) = 870,000 pounds per square inch.
.....	600	.0674	.0301	
.....	600	.0674	.0301	

No. 1765—Continued.

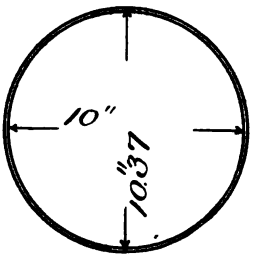
Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
124,201	1,100	.0957	.0412	Snapping sounds.
135,492	1,200	.1126	.0553	
146,783	1,300	.1322	.0716	
158,074	1,400	.1529	.0893	
169,365	1,500	.1747	.1083	E (1,000-1,500)=1,613,000 pounds per square inch.
.....	600	.1410	.1083	
.....	600	.1406	.1083	
.....	200	.1159	.....	
.....	400	.1298	.....	
.....	600	.1404	.....	
.....	800	.1496	.....	
.....	1,000	.1582	.....	
.....	800	.1530	.....	
.....	600	.1460	.....	
.....	400	.1358	.....	
.....	200	.1204	.1090	
180,656	1,600	.1954	.1263	
191,947	1,700	.2185	.1464	
203,238	1,800	.2408	.1658	
.....	600	.1960	.1660	
.....	600	.1956	.1659	
288,000	2,551	.....	.....	Ultimate strength.

Cracks in the exterior shell gradually increased after first appearing under the load of 1,500 pounds per square inch. A hoop fractured when the maximum stress was reached, a sudden loss in resistance then occurring.

No. 1755.

1 : 3 : 6 Mixture.

Reënforced with 25 hoops, each 1″.04 wide by ″.06 thick, spaced 4″ apart, center to center. Hoops held in position during construction by means of fine wires attached to the mold.



Composition, by volume: Alpha cement, 1; sand (10-mesh sieve), 3; cinders, 6. Water, 75 per cent of cement, by weight.

Age, set in air, 1 year.

Weight of column, total, 476 pounds.

Weight of concrete, 458.25 pounds = 98.3 pounds per cubic foot.

Weight of hoops, 17.75 pounds.

Height of column, 96.05 inches.

Diameter of column, 10.37 inches.

Sectional area, gross, 84.46 square inches.

No vertical bars used.

Gauged length, 50″.

A number of hoops were loose over the concrete at the commencement of the test.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
8,446	100	0.	0.	Initial load. Loaded with 6,000 pounds before testing.
12,667	150	.0056	.0018	
16,892	200	.0121	.0038	
21,115	250	.0193	.0066	
25,338	300	.0273	.0098	
29,561	350	.0365	.0140	
33,784	400	.0473	.0191	
38,007	450	.0598	.0254	
42,230	500	.0748	.0340	
46,453	550	.0923	.0445	
50,676	600	.1133	.0576	E (100-600) = 449,000 pounds per square inch.
.....	600	.1187	.0621	
54,899	650	.1375	.0736	
59,122	700	.1640	.0916	
63,345	750	.2010	.1164	
67,568	800	.2695	.1680	E (600-800) = 218,000 pounds per square inch.
.....	600	.2486	.1698	
.....	600	.2497	.1710	
.....	200	.1895	.....	
.....	300	.2084	.....	
.....	400	.2243	.....	
.....	500	.2378	.....	
.....	600	.2498	.....	
.....	500	.2416	.....	
.....	400	.2314	.....	
.....	300	.2178	.....	
.....	200	.1997	.1731	
71,600	848	.....	.....	Ultimate strength.

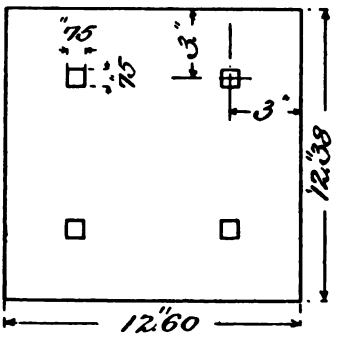
Column failed near middle of height.

The concrete crushed and hoop ruptured.

No. 1784.

1 : 2 : 4 Mixture.

Reënforced with four ¾-inch square twisted steel bars. Bars were flush with the lower end and projected above the surface of the upper end of the column. A perforated plate was used to cap the upper end, the plate having clearance holes which received the projecting ends of the twisted steel bars. At this end the loads were thus applied to the concrete only.



Composition, by volume: Alpha cement, 1; sand (10-mesh sieve), 2; trap rock (¼" to 1½"), 4. Water, 52.4 per cent of cement, by weight.

Age, set in air, 1 year 5 months 21 days.

Weight of column, total, 1,316 pounds.

Weight of concrete, 1,256 pounds = 150.1 pounds per cubic foot.

Weight of steel bars, 60 pounds.

Height of column, 94.08 inches.

Sectional area, gross, 12".38 × 12".60 = 155.99 square inches.

Sectional area of vertical bars, ".75 × ".75 = ".5625 × 4 = 2.25 square inches.

Gauged length, 50".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
15,599	100	0.	0.	Initial load. Loaded with 18,000 pounds before testing.
23,399	150	.0010	0.	
31,198	200	.0023	.0004	
38,998	250	.0036	.0007	
46,797	300	.0050	.0009	
54,597	350	.0061	.0011	
62,396	400	.0073	.0014	
70,196	450	.0089	.0017	
77,995	500	.0098	.0017	
85,945	550	.0112	.0019	
93,594	600	.0123	.0021	E (100-600) = 2,451,000 pounds per square inch.
.....	600	.0123	.0021	
101,394	650	.0135	.....	
109,193	700	.0144	.....	
116,993	750	.0156	.....	
124,792	800	.0168	.....	
132,592	850	.0179	.....	
140,391	900	.0189	.....	
148,191	950	.0199	.....	
155,990	1,000	.0211	.0032	E (600-1,000) = 2,597,000 pounds per square inch.

No. 1784—Continued.

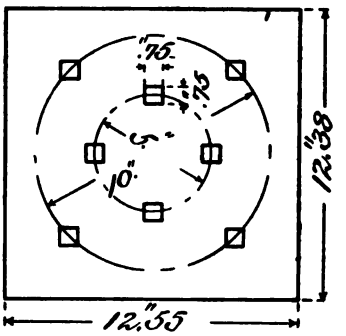
Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
.....	600	.0147	.0032	
.....	600	.0147	.0032	
171,589	1,100	.0236	.....	
187,188	1,200	.0258	.....	
202,787	1,300	.0279	.....	
218,386	1,400	.0303	.....	
233,985	1,500	.0329	.0046	
.....	600	.0182	.0046	
.....	600	.0182	.0046	
249,584	1,600	.0359	.....	
265,183	1,700	.0384	.....	
280,782	1,800	.0412	.....	
296,381	1,900	.0445	.....	
311,980	2,000	.0479	.0073	E (1,500–2,000=2,033,000 pounds per square inch.
.....	600	.0235	.0072	
.....	600	.0233	.0071	
327,579	2,100	.0542	.....	
343,178	2,200	.0589	.....	
358,777	2,300	.0670	.....	Ultimate strength.

Column failed at the lower end, opening oblique and longitudinal cracks in the lower 2 feet of its height.

No. 1785.

1 : 2 : 4 Mixture.

Reënforced with eight ¾″ twisted steel bars. Bars were flush with the lower end and projected above the surface of the upper end of the column. A perforated plate was used to cap the upper end, the plate having clearance holes which received the projecting ends of the twisted steel bars. At this end the loads were thus applied to the concrete only.



Composition, by volume: Alpha cement, 1; sand (10-mesh sieve), 2; trap rock (¾″ to 1½″), 4. Water, 52.4 per cent of cement.

Age, set in air, 1 year 5 months 22 days.

Weight of column, total, 1,364 pounds.

Weight of concrete, 1,244 pounds = 151.3 pounds per cubic foot.

Weight of steel bars, 120 pounds.

Height of column, 94.15 inches.

Sectional area, gross, 12″.55 × 12″.38 = 155.37 square inches.

Sectional area of vertical bars, ″.75 × ″.75 = ″.5625 × 8 = 4.50 square inches.

Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
15,537	100	0.	0.	Initial load. Loaded with 16,000 pounds before testing.
23,306	150	.0008	0.	
31,074	200	.0015	.0002	
38,843	250	.0024	.0003	
46,611	300	.0034	.0005	
54,380	350	.0044	.0007	
62,148	400	.0056	.0009	
69,917	450	.0066	.0010	
77,685	500	.0076	.0011	
85,454	550	.0086	.0012	
93,222	600	.0097	.0013	E (100–600) = 2,976,000 pounds per square inch.
.....	600	.0097	.0014	
100,991	650	.0105	.....	
108,759	700	.0115	.....	
116,528	750	.0124	.....	
124,296	800	.0133	.....	
132,065	850	.0142	.....	
139,833	900	.0151	.....	
147,602	950	.0160	.....	
155,370	1,000	.0170	.0020	E (600–1,000) = 3,030,000 pounds per square inch.

No. 1785—Continued.

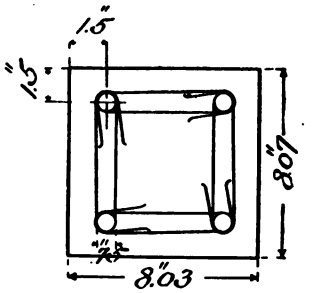
Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
.....	600	.0113	.0020	
.....	600	.0111	.0020	
170,907	1,100	.0189	.....	
186,444	1,200	.0207	.....	
201,981	1,300	.0222	.....	
217,518	1,400	.0240	.....	
233,055	1,500	.0259	.0030	E (1,000–1,500)=3,165,000 pounds per square inch.
.....	600	.0131	.0030	
.....	600	.0131	.0030	
248,592	1,600	.0280	.....	
264,129	1,700	.0298	.....	
279,666	1,800	.0316	.....	
295,203	1,900	.0335	.....	
310,740	2,000	.0360	.0043	E (1,500–2,000)=2,841,000 pounds per square inch.
.....	600	.0151	.0042	
.....	600	.0151	.0042	
326,277	2,100	.0380	.....	
341,814	2,200	.0398	.....	
357,351	2,300	.0418	.....	
372,888	2,400	.0440	.....	
388,425	2,500	.0462	.0054	E (2,000–2,500)=2,747,000 pounds per square inch.
.....	600	.0177	.0052	
.....	600	.0176	.0052	
403,962	2,600	.0500	.....	
419,499	2,700	.0522	.....	
435,036	2,800	.0549	.....	
450,573	2,900	.0578	.....	
466,110	3,000	.0600	.0069	E (2,500–3,000)=2,033,000 pounds per square inch.
.....	600	.0208	.0068	
.....	600	.0205	.0065	
481, 47	3,100	.0654	.....	
497,184	3,200	.0683	.....	
512,721	3,300	.0717	.....	
528,258	3,400	.0748	.....	
543,795	3,500	.0790	.0086	E (3,000–3,500)=1,445,000 pounds per square inch.
.....	600	.0254	.0085	
.....	600	.0255	.0085	
559,332	3,600	.0877	.0098	
.....	600	.0282	.0094	
.....	600	.0284	.0094	
574,869	3,700	.0972	.0107	Ultimate strength.
.....	600	.0314	.0106	
.....	.....	.....	.0100	Set after 30 minutes.
.....	200	.0131	.....	
.....	400	.0224	.....	
.....	600	.0309	.....	
.....	800	.0381	.....	
.....	1,000	.0449	.....	
.....	800	.0398	.....	
.....	600	.0330	.....	
.....	400	.0240	.....	
.....	200	.0142	.0104	
.....	600	.0314	.....	
.....	1,000	.0448	.....	
.....	2,000	.0684	.....	
.....	3,000	.0866	.....	
.....	2,000	.0735	.....	
.....	1,000	.0503	.....	
.....	600	.0348	.0104	

Cracks, oblique and longitudinal, appeared under load of 3,500 pounds per square inch, short cracks near the lower end and 1 to 3 feet from the upper end. The appearance of the cracks at the lower end did not materially change thereafter. The cracks near the upper end were slightly more pronounced when the load was advanced to 3,700 pounds per square inch. After loading with 3,700 pounds per square inch a series of loads were applied of less magnitude. Upon completing these, higher stresses were applied. The column did not again display a resistance of 3,700 pounds per square inch, but failed at the upper end under a total load of 540,000 pounds. A section about 12″ average length was partially detached from the rest of the column by oblique cracks, overcoming the adhesive resistance with the sides of the twisted steel bars along this part of their length.

No. 1769.

1 : 2 : 4 Mixture.

Hennebique type of reënforcement. Reënforcement consists of four longitudinal, hard steel bars, ¾″ diameter each, extending from the bottom, where they rested on a grille flush with the lower end of the column, to a grille ¾″ below the upper end. The longitudinal bars were embraced by collars at intervals of 6″ each; the collars were made of steel hooping ½″ wide, No. 20 gauge thick. The collars had overlapping ends, imbedded in the concrete. The grilles provided above and below the longitudinal bars were made of hoop steel 1″ wide by No. 18 gauge thick; each grille was composed of twelve pieces, 6½″ long each.



Composition, by volume: Alpha cement, 1; sand (10-mesh sieve), 2; trap rock (¾″), 4. Water, 52.4 per cent of cement, by weight.

Age, set in air, 11 months.

Weight of column, total, 571 pounds.

Weight of concrete, 516.5 pounds = 145.5 pounds per cubic foot.

Weight of reënforcement, complete, 54.5 pounds.

Height of column, 97.60 inches.

Sectional area of column, gross, 8″.03 × 8″.07 = 64.80 square inches.

Sectional area of vertical bars, total, 1.77 square inches.

Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
6,480	100	0.	0.	Initial load. Loaded with 6,000 pounds before testing.
9,720	150	.0013	0.	
12,960	200	.0027	.0002	
16,200	250	.0039	.0003	
19,440	300	.0054	.0004	
22,680	350	.0069	.0005	
25,920	400	.0083	.0008	
29,160	450	.0097	.0010	
32,400	500	.0112	.0011	
35,640	550	.0125	.0012	
38,880	600	.0140	.0013	E (100-600) = 1,968,000 pounds per square inch.
.....	600	.0140	.0014	
42,120	650	.0153	.....	
45,360	700	.0168	.....	
48,600	750	.0180	.....	
51,840	800	.0193	.....	
55,080	850	.0206	.....	
58,320	900	.0219	.....	
61,560	950	.0231	.....	
64,800	1,000	.0243	.0023	E (600-1,000) = 2,151,000 pounds per square inch.

No. 1769—Continued.

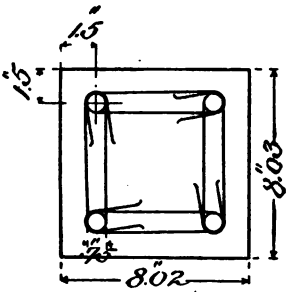
Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
.....	600	.0165	.0023	
.....	600	.0165	.0024	
71,280	1,100	.0270	.....	
77,760	1,200	.0293	.....	
84,240	1,300	.0321	.....	
90,720	1,400	.0344	.....	
97,200	1,500	.0371	.0034	E (1,000-1,500)=2,137,000, pounds per square inch.
.....	600	.0193	.0035	
.....	600	.0192	.0035	
103,680	1,600	.0400	.....	
110,160	1,700	.0427	.....	
116,640	1,800	.0453	.....	
123,120	1,900	.0484	.....	
129,600	2,000	.0510	.0052	E (1,500-2,000)=2,066,000 pounds per square inch.
.....	600	.0224	.0052	
.....	600	.0224	.0052	
136,080	2,100	.0554	.....	
142,560	2,200	.0589	.....	
149,040	2,300	.0618	.....	
155,520	2,400	.0652	.....	
162,000	2,500	.0689	.0076	E (2,000-2,500)=1,613,000 pounds per square inch.
.....	600	.0271	.0073	
.....	600	.0267	.0073	
168,480	2,600	.0748	.....	
174,960	2,700	.0776	.....	
181,440	2,800	.0820	.....	
187,920	2,900	.0864	.....	
194,400	3,000	.0907	.0109	E (2,500-3,000)=1,351,000 pounds per square inch. Crack at corner of column.
.....	600	.0325	.0105	
.....	600	.0324	.0105	
200,880	3,100	.0985	.....	
207,360	3,200	.1027	.....	
217,000	3,349	.....	.....	Ultimate strength.

Column failed at the upper end. Opened oblique and longitudinal cracks in the concrete. The concrete above the upper grille crushed, and the strips composing the grille were indented by the longitudinal bars.

No. 1770.

1 : 2 : 4 Mixture.

Hennebique type of reënforcement. Reënforcement consisted of four longitudinal, hard steel bars, $\frac{3}{4}''$ diameter each, resting upon a grille at the lower end of the column and flush therewith, while another grille at the top rested upon the longitudinal bars. There was about $\frac{3}{4}''$ thickness of concrete above the upper grille. The grilles were composed of hoop steel, and hoop steel collars embraced the longitudinal bars, the same as in column No. 1769.



Composition, by volume: Alpha cement, 1; sand (10-mesh sieve), 2; trap rock ($\frac{3}{4}''$), 4. Water, 46.8 per cent of cement, by weight.

Age, set in air, 11 months.

Weight of column, total, 565 pounds.

Weight of concrete, 510.5 pounds = 145 pounds per cubic foot.

Weight of reënforcement, complete, 54.5 pounds.

Height of column, 97.55 inches.

Sectional area of column, gross, 8".02 × 8".03 = 64.4 square inches.

Sectional area of vertical bars, total, 1.77 square inches.

Gauged length, 50".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
6,440	100	0.	0.	Initial load. Loaded with 6,000 pounds before testing.
9,660	150	.0014	.0002	
12,880	200	.0029	.0006	
16,100	250	.0045	.0005	
19,320	300	.0059	.0008	
22,540	350	.0074	.0009	
25,760	400	.0090	.0011	
28,980	450	.0105	.0013	
32,200	500	.0122	.0015	
35,420	550	.0136	.0017	
38,640	600	.0150	.0018	E (100-600) = 1,894,000 pounds per square inch.
.....	600	.0152	.0018	
41,860	650	.0165	.....	
45,080	700	.0179	.....	
48,300	750	.0193	.....	
51,520	800	.0208	.....	
54,740	850	.0220	.....	
57,960	900	.0234	.....	
61,180	950	.0248	.....	
64,400	1,000	.0262	.0027	E (600-1,000) = 1,942,000 pounds per square inch.

No. 1770—Continued.

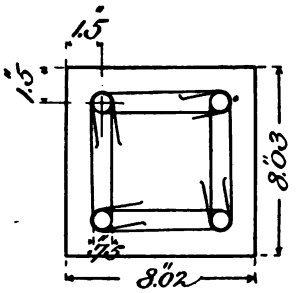
Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
.....	600	.0178	.0027	
.....	600	.0177	.0027	
70,840	1,100	.0288	.....	
77,280	1,200	.0312	.....	
83,720	1,300	.0339	.....	
90,160	1,400	.0366	.....	
96,600	1,500	.0398	.0037	E (1,000–1,500)=1,984,000 pounds per square inch.
.....	600	.0207	.0037	
.....	600	.0207	.0037	
103,040	1,600	.0430	.....	
109,480	1,700	.0460	.....	
115,920	1,800	.0491	.....	
122,360	1,900	.0523	.....	
128,800	2,000	.0556	.0051	E (1,500–2,000)=1,736,000 pounds per square inch.
.....	600	.0243	.0051	
.....	600	.0241	.0052	
135,240	2,100	.0606	.....	
141,680	2,200	.0640	.....	
148,120	2,300	.0680	.....	
154,560	2,400	.0724	.....	
161,000	2,500	.0769	.0083	E (2,000–2,500)=1,381,000 pounds per square inch.
.....	600	.0298	.0083	
.....	600	.0298	.0083	
167,440	2,600	.0842	.....	Crack developed at corner of column.
173,880	2,700	.0883	.....	
180,320	2,800	.0921	.....	
186,760	2,900	.0980	.....	Ultimate strength.

Column failed at the upper end, opening oblique and longitudinal cracks in the concrete. The concrete at the upper end of the column, above the grille, crushed locally, and the strips composing the grille were indented by the longitudinal bars.

No. 1771.

1 : 2 : 4 Mixture.

Hennebique type of reënforcement. Reënforcement consisted of four longitudinal, medium steel bars, $\frac{3}{4}''$ diameter each, and hoop steel grilles, above and below the longitudinal bars, and collars as in column No. 1769.



Composition, by volume: Alpha cement, 1; sand (10-mesh sieve), 2; trap rock ($\frac{3}{4}''$), 4. Water, 58.4 per-cent of cement, by weight.
Age, set in air, 11 months.
Weight of column, total, 564 pounds.
Weight of concrete, 509.5 pounds = 144.7 pounds per cubic foot.
Weight of reënforcement, complete, 54.5 pounds.
Height of column, 97.55 inches.
Sectional area of column, gross, $8''.02 \times 8''.03 = 64.4$ square inches.
Sectional area of vertical bars, total, 1.77 square inches.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
6,440	100	0.	0.	Initial load. Loaded with 5,000 pounds before testing.
9,660	150	.0015	.0003	
12,880	200	.0032	.0006	
16,100	250	.0049	.0009	
19,320	300	.0066	.0011	
22,540	350	.0086	.0013	
25,760	400	.0102	.0012	
28,980	450	.0119	.0014	
32,200	500	.0137	.0018	
35,420	550	.0154	.0019	
38,640	600	.0169	.0020	E (100–600) 1,678,000 pounds per square inch.
.....	600	.0170	.0021	
41,860	650	.0187	.....	
45,080	700	.0201	.....	
48,300	750	.0218	.....	
51,520	800	.0232	.....	
54,740	850	.0249	.....	
57,960	900	.0264	.....	
61,180	950	.0278	.....	
64,400	1,000	.0294	.0031	E (600–1,000) = 1,754,000 pounds per square inch.
.....	600	.0200	.0031	
.....	600	.0200	.0031	
70,840	1,100	.0319	.....	
77,280	1,200	.0349	.....	
83,720	1,300	.0379	.....	
90,160	1,400	.0410	.....	
96,600	1,500	.0442	.0046	E (1,000–1,500) = 1,880,000 pounds per square inch.

No. 1771—Continued.

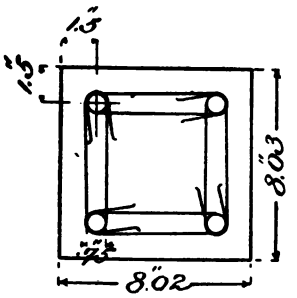
Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
.....	600	.0233	.0044	
.....	600	.0233	.0044	
103,040	1,600	.0480	.....	
109,480	1,700	.0518	.....	
115,920	1,800	.0557	.....	
122,360	1,900	.0607	.....	
128,800	2,000	.0680	.0140	E (1,500-2,000)=1,736,000 pounds per square inch.
.....	600	.0344	.0140	
.....	600	.0343	.0140	
135,240	2,100	.0774	.....	
141,680	2,200	.0868	.....	
148,120	2,300	.0994	.....	Cracks in sight 2½ feet from lower end.
154,560	2,400	.1180	.0575	
.....	600	.0734	.0545	
.....	600	.0734	.0545	
157,000	2,438	.....	.....	Ultimate strength.

Column failed at upper end. Opened oblique and longitudinal cracks in the concrete. The concrete above the upper grille, about ¾″ in thickness, crushed locally, and the strips composing the grille were indented by the longitudinal bars.

No. 1772.

1 : 2 : 4 Mixture.

Hennebique type of reënforcement. Reënforced with four longitudinal, medium steel bars, $\frac{3}{4}''$ diameter each; hoop steel-grilles and collars as in column No. 1769.



Composition, by volume: Alpha cement, 1; sand (10-mesh sieve), 2; trap rock ($\frac{3}{4}''$), 4. Water, 35.1 per cent of cement.

Age, set in air, 11 months.

Weight of column, total, 570 pounds.

Weight of concrete, 515.5 pounds = 146.4 pounds per cubic foot.

Weight of reënforcement, complete, 54.5 pounds.

Height of column, 97.50 inches.

Sectional area of column, gross, $8''.02 \times 8''.03 = 64.4$ square inches.

Sectional area of vertical bars, total, 1.77 square inches.

Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
6,440	100	0.	0.	Initial load. Loaded with 5,000 pounds before testing.
9,660	150	.0014	.0003	
12,880	200	.0028	.0004	
16,100	250	.0041	.0005	
19,320	300	.0056	.0006	
22,540	350	.0071	.0007	
25,760	400	.0089	.0009	
28,980	450	.0104	.0010	
32,200	500	.0120	.0011	
35,420	550	.0135	.0014	
38,640	600	.0150	.0015	E (100-600) = 1,852,000 pounds per square inch.
.....	600	.0150	.0016	
41,860	650	.0166	.....	
45,080	700	.0180	.....	
48,300	750	.0194	.....	
51,520	800	.0208	.....	
54,740	850	.0223	.....	
57,960	900	.0235	.....	
61,180	950	.0249	.....	
64,400	1,000	.0263	.0027	E (600-1,000) = 1,980,000 pounds per square inch.
.....	600	.0179	.0025	
.....	600	.0177	.0025	
70,840	1,100	.0289	.....	
77,280	1,200	.0315	.....	
83,720	1,300	.0340	.....	
90,160	1,400	.0368	.....	
96,600	1,500	.0397	.0039	E (1,000-1,500) = 2,049,000 pounds per square inch.

No. 1772—Continued.

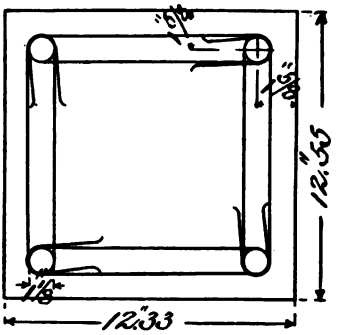
Applied loads.		In gauged length		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
.....	600	.0210	.0039	
.....	600	.0209	.0039	
20,000	.....	.....	.....	Rested under this load 17 hours.
.....	100	.....	.0039	
103,040	1,600	.0422	.....	
109,480	1,700	.0453	.....	
115,920	1,800	.0481	.....	
122,360	1,900	.0517	.....	
128,800	2,000	.0551	.0071	E (1,500-2,000)=2,049,000 pounds per square inch.
.....	600	.0255	.0071	
.....	600	.0254	.0071	
135,240	2,100	.0595	.....	
141,680	2,200	.0635	.....	
148,120	2,300	.0684	.....	
154,560	2,400	.0730	.....	
161,000	2,500	.0798	.0184	E (2,000-2,500)=1,866,000 pounds per square inch.
.....	600	.0375	.0184	
.....	600	.0374	.0184	
167,440	2,600	.1000	.....	Crack in sight.
		.1048	.0405	
167,440	2,600	.....	.....	Ultimate strength.

Failed on second application of load of 2,600 pounds per square inch. Concrete opened oblique and longitudinal cracks at lower end of column.

No. 1786.

1 : 2 : 4 Mixture.

Hennebique type of reënforcement. Reënforcement consists of four $1\frac{1}{8}$″ diameter medium steel bars, 52 collars (20 gauge, $\frac{1}{2}$″ wide) embracing bars, and end grilles of flat steel strips $1\frac{1}{2}$″ wide by ″.046 thick.



Composition, by volume: Alpha cement, 1; sand (10-mesh sieve), 2; trap rock ($\frac{3}{4}$″ to $1\frac{1}{2}$″), 4. Water, 43.7 per cent of cement, by weight.

Age, set in air, 1 year 3 months 16 days.

Weight of column, total, 1,420 pounds.

Weight of concrete, 1,298 pounds = 152.2 pounds per cubic foot.

Weight of cage, complete, 122 pounds.

Height of column, 98 inches.

Sectional area, gross, 12″.55 × 12″.33 = 154.74 square inches.

Sectional area of vertical bars, total, 3.98 square inches.

Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
15,474	100	0.	0.	Initial load. Loaded with 8,000 pounds before testing.
23,211	150	.0009	0.	
30,948	200	.0020	.0002	
38,685	250	.0030	.0004	
46,422	300	.0041	.0006	
54,159	350	.0053	.0007	
61,896	400	.0063	.0009	
69,633	450	.0075	.0010	
77,370	500	.0085	.0011	
85,107	550	.0095	.0012	
92,844	600	.0105	.0012	E (100–600) = 2,688,000 pounds per square inch.
.....	600	.0105	.0012	
100,581	650	.0117	.....	
108,318	700	.0124	.....	
116,055	750	.0134	.....	
123,792	800	.0140	.....	
131,529	850	.0150	.....	
139,266	900	.0160	.....	
147,003	950	.0169	.....	
154,740	1,000	.0178	.0018	E (600–1,000) = 2,985,000 pounds per square inch.

No. 1787—Continued.

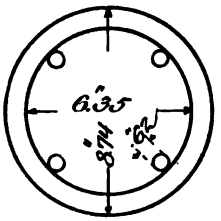
Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
.....	600	.0132	.0024	
.....	600	.0131	.0024	
170,093	1,100	.0210	.....	
185,556	1,200	.0228	.....	
201,019	1,300	.0248	.....	
216,482	1,400	.0262	.....	
231,945	1,500	.0288	.0035	E (1,000-1,500)=2,874,000 pounds per square inch.
.....	600	.0152	.0034	
.....	600	.0152	.0032	
247,408	1,600	.0312	.....	
262,871	1,700	.0329	.....	
278,334	1,800	.0348	.....	
293,797	1,900	.0370	.....	
309,260	2,000	.0396	.0046	E (1,500-2,000)=2,577,000 pounds per square inch.
.....	600	.0180	.0045	
.....	600	.0180	.0045	
324,723	2,100	.0432	.....	
340,186	2,200	.0454	.....	
355,649	2,300	.0480	.....	
371,112	2,400	.0510	.....	
386,575	2,500	.0542	.0090	E (2,000-2,500)=2,451,000 pounds per square inch.
.....	600	.0234	.0090	
.....	600	.0234	.0090	
402,038	2,600	.0610	.....	
417,501	2,700	.0659	.....	
432,964	2,800	.0730	.....	
448,427	2,900	.0828	.....	
463,890	3,000	.0935	.0395	E (2,500-3,000)=2,841,000 pounds per square inch.
.....	600	.0523	.0395	
.....	600	.0520	.0394	
478,000	3,091	.....	.....	Ultimate strength.

Column failed at the upper end. Opened oblique and longitudinal cracks, eventually buckling the $1\frac{1}{8}''$ bars. There was a layer of concrete $1\frac{1}{2}''$ deep above the grille at the upper end of the column. During the progress of rupture a pyramidal-shaped piece, having its base at the upper end surface of the column, forced off sides of the column in the vicinity of the buckled parts of the longitudinal bars.

No. 1776.

1 : 2 Mortar.

Hennebique type of reënforcement. Reënforced by means of a steel wire helix, $\frac{1}{4}''$ diameter of wire, 2″ pitch; interior diameter of helix, 6″.35. Also 4 longitudinal steel bars ″.62 diameter each. Hoop steel grilles above and below helix and bars; lower grille flush with lower end of column; about $\frac{3}{4}''$ depth of concrete above the upper grille.



Composition, by volume: Alpha cement, 1; sand (10-mesh sieve), 2. Water, 46.8 per cent of cement, by weight.

Age, set in air, 9 months 20 days.

Weight of column, total, 462 pounds.

Weight of concrete, 407 pounds = 127.2 pounds per cubic foot.

Weight of reënforcement, complete, 55 pounds.

Height of column, 95.50 inches.

Diameter of column, 8″.74 inches.

Sectional area of column, gross, 59.99 square inches.

Sectional area of vertical bars, total, 1.21 square inches.

Gauged length, 50″.

There were a number of minute, transverse cracks in surface of column, thought to be shrinkage cracks, at commencement of the test.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
5,999	100	0.	0.	Initial load. Loaded with 7,000 pounds before testing.
8,999	150	.0030	.0011	
11,998	200	.0063	.0018	
14,998	250	.0095	.0028	
17,997	300	.0127	.0032	
20,997	350	.0163	.0039	
23,996	400	.0194	.0043	
26,996	450	.0225	.0048	
29,995	500	.0255	.0050	
32,995	550	.0279	.0054	
35,994	600	.0303	.0055	E (100–600) = 1,008,000 pounds per square inch.
.....	600	.0305	.0056	
38,994	650	.0325	.....	
41,993	700	.0345	.....	
44,993	750	.0363	.....	
47,992	800	.0380	.....	
50,992	850	.0399	.....	
53,991	900	.0415	.....	
56,991	950	.0433	.....	
59,990	1,000	.0449	.0068	E (600–1,000) = 1,504,000 pounds per square inch.
.....	600	.0342	.0069	
.....	600	.0337	.0065	
65,989	1,100	.0473	.....	
71,988	1,200	.0500	.....	
77,987	1,300	.0526	.....	
83,986	1,400	.0554	.....	
89,985	1,500	.0580	.0093	E (1,000–1,500) = 2,358,000 pounds per square inch.

No. 1776—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
.....	600	.0367	.0091	
.....	600	.0365	.0091	
20,000	.....	.....	.....	Column rested under this load 21 hours.
.....	100	.....	.0097	
.....	600	.0368	.0098	
95,984	1,600	.0610	.....	
101,983	1,700	.0635	.....	
107,982	1,800	.0664	.....	
113,981	1,900	.0688	.....	
119,890	2,000	.0723	.0190	E (1,500-2,000) = 5,435,000 pounds per square inch.
.....	600	.0425	.0187	
.....	600	.0424	.0184	
125,979	2,100	.0756	.....	
131,978	2,200	.0780	.....	
137,977	2,300	.0807	.....	
143,976	2,400	.0839	.....	
149,975	2,500	.0873	.0328	
.....	600	.0506	.0328	
.....	600	.0504	.0328	
.....	500	.0478	.....	
.....	1,000	.0603	.....	
.....	1,500	.0693	.....	
.....	2,000	.0784	.....	
.....	1,500	.0706	.....	
.....	1,000	.0612	.....	
.....	500	.0498	.0330	
155,974	2,600	.0933	.....	Opened longitudinal crack at upper end of column.
161,973	2,700	.0949	.....	
167,972	2,800	.0968	.0408	
.....	600	.0545	.0405	
.....	600	.0544	.0406	
.....	500	.0522	.....	
.....	1,000	.0627	.....	
.....	1,500	.0722	.....	
.....	2,000	.0810	.....	
.....	2,500	.0897	.....	
.....	2,000	.0820	.....	
.....	1,500	.0739	.....	
.....	1,000	.0647	.....	
.....	500	.0541	.0409	
172,000	2,867	.....	.....	Ultimate strength.

Column failed at the upper end. Cracks developed in the outer shell, the shell flaking off from the core. For a brief interval the mortar within the helix sustained the maximum stress reached, followed by the development of oblique cracks in the mortar and reduction of strength.

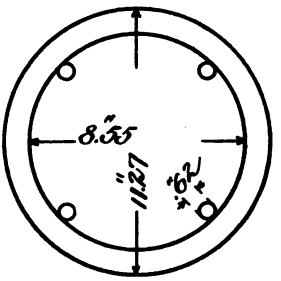
Attention is invited to the apparently abnormal behavior of this column, as shown by the computed moduli of elasticity. Unusual rigidity prevailed above the load of 2,000 pounds per square inch. Below this stress the rate of change in the value is also unusual. This erratic behavior is attributed to local causes affecting the outer sleeve of concrete.

Referred to the sectional area within the helix, 6″.35 diameter, the maximum stress reached was 5,431 pounds per square inch.

No. 1777.

1 : 2 : 2 Mixture.

Hennebique type of reënforcement. Reënforced by means of a steel wire helix, ″.30 diameter of wire, 1½″ pitch; interior diameter of helix, 8″.55. Also by 4 longitudinal steel bars, ″.62 diameter each. Hoop-steel grilles used above and below helix and bars. Lower grille flush with lower end of column; about ¾″ depth of concrete above upper grille.



Composition, by volume: Alpha cement, 1; sand (10-mesh sieve), 2; trap rock (¾″), 2. Water, 46.8 per cent of cement, by weight.

Age, set in air, 10 months.

Weight of column, total, 809 pounds.

Weight of concrete, 729 pounds = 143.5 pounds per cubic foot.

Weight of reënforcement, complete, 80 pounds.

Height of column, 90.85 inches.

Diameter of column, 11.27 inches.

Sectional area of column, gross, 99.76 square inches.

Sectional area of vertical bars, total, 1.21 square inches.

Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
9,976	100	0.	0.	Initial load. Loaded with 7,000 pounds before testing.
14,964	150	.0006	0.	
19,953	200	.0012	0.	
24,940	250	.0019	.0001	
29,928	300	.0027	.0002	
34,916	350	.0033	.0002	
39,904	400	.0039	.0003	
44,892	450	.0047	.0004	
49,880	500	.0053	.0005	
54,868	550	.0062	.0006	
59,856	600	.0069	.0007	E (100–600) = 4,032,000 pounds per square inch.
.....	600	.0069	.0007	
64,844	650	.0076	.....	
69,832	700	.0084	.....	
74,820	750	.0093	.....	
79,808	800	.0098	.....	
84,796	850	.0107	.....	
89,784	900	.0114	.....	
94,772	950	.0121	.....	
99,760	1,000	.0130	.0014	E (600–1,000) = 3,704,000 pounds per square inch.

No. 1777—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
.....	600	.0079	.0014	
.....	600	.0079	.0014	
109,736	1,100	.0148	.....	
119,712	1,200	.0163	.....	
129,688	1,300	.0180	.....	
139,664	1,400	.0197	.....	
149,640	1,500	.0213	.0026	E (1,000–1,500) = 3,521,000 pounds per square inch.
.....	600	.0094	.0024	
.....	600	.0094	.0024	
159,616	1,600	.0233	.....	
169,592	1,700	.0253	.....	
179,568	1,800	.0274	.....	
189,544	1,900	.0304	.....	
199,520	2,000	.0330	.0051	E (1,500–2,000) = 2,717,000 pounds per square inch. Cracks near upper end.
.....	600	.0133	.0051	
.....	600	.0130	.0050	
209,496	2,100	.0320	.....	
219,472	2,200	.0334	.....	
229,448	2,300	.0347	.....	
239,424	2,400	.0363	.....	
249,400	2,500	.0387	.0060	E (2,000–2,500) = 5,208,000 pounds per square inch.
.....	600	.0134	.0059	
.....	600	.0130	.0058	
259,376	2,600	.0403	.....	
269,352	2,700	.0417	.....	
279,328	2,800	.0427	.....	
289,304	2,900	.0440	.....	
299,280	3,000	.0450	.0075	E (2,500–3,000) = 5,208,000 pounds per square inch.
.....	600	.0143	.0074	
.....	600	.0143	.0071	
435,000	4,360	.....	.....	Ultimate strength.

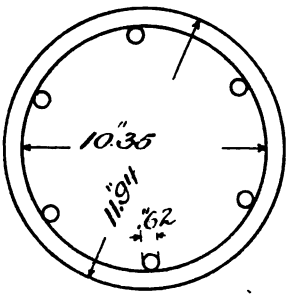
Column failed at the upper end. The outer shell of concrete flaked off along the upper third of the column. The concrete within the helix developed oblique cracks in the vicinity of the upper end of the column. The outer shell of concrete was detached from the portion within the helix prior to reaching the maximum load.

Referred to the sectional area within the helix, 8″.55 diameter, the maximum stress reached was 7,577 pounds per square inch.

No. 1778.

1 : 2 : 2 Mixture.

Hennebique type of reënforcement. Reënforced by means of steel wire helix, $\frac{5}{16}$″ diameter of wire, 1″ pitch; interior diameter of helix, 10″.35. Also by 6 hard steel longitudinal bars, ″.62 diameter each. Hoop steel grilles above and below helix and bars. Lower grille flush with end of column; about $\frac{3}{4}$″ depth of concrete above upper grille.



Composition, by volume: Alpha cement, 1; sand (10-mesh sieve), 2; trap rock ($\frac{3}{4}$″), 2. Water, 43.7 per cent of cement, by weight.

Age, set in air, 10 months 14 days.

Weight of column, total, 970 pounds.

Weight of concrete, 844 pounds = 145.5 pounds per cubic foot.

Weight of reënforcement, complete, 126 pounds.

Height of column, 93.70 inches.

Diameter of column, 11.94 inches.

Sectional area of column, gross, 111.97 square inches.

Sectional area of vertical bars, total, 1.81 square inches.

Gauged length, 50″.

Shell of concrete, outside of the helix, porous in places.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
11,197	100	0.	0.	Initial load. Loaded with 8,000 pounds before testing.
16,796	150	.0005	0.	
22,394	200	.0010	0.	
27,993	250	.0015	0.	
33,591	300	.0021	0.	
39,190	350	.0028	0.	
44,788	400	.0034	0.	
50,387	450	.0043	.0001	
55,985	500	.0049	.0002	
61,584	550	.0057	.0003	
67,182	600	.0064	.0004	E (100–600) = 4,167,000 pounds per square inch.
.....	600	.0064	.0004	
72,781	650	.0071	.....	
78,379	700	.0078	.....	
83,978	750	.0088	.....	
89,576	800	.0094	.....	
95,175	850	.0102	.....	
100,773	900	.0109	.....	
106,372	950	.0118	.....	
111,970	1,000	.0125	.0009	E (600–1,000) = 3,571,000 pounds per square inch.

No. 1778—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Sets.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
.....	600	.0072	.0009	
.....	600	.0072	.0008	
123,167	1,100	.0140	.....	
134,364	1,200	.0156	.....	
145,561	1,300	.0172	.....	
156,758	1,400	.0189	.....	
167,955	1,500	.0204	.0017	E (1,000-1,500)=3,521,000 pounds per square inch.
.....	600	.0081	.0017	
.....	600	.0081	.0017	
179,152	1,600	.0223	.....	
190,349	1,700	.0239	.....	
201,546	1,800	.0253	.....	
212,743	1,900	.0270	.....	
223,940	2,000	.0289	.0026	E (1,500-2,000)=3,289,000 pounds per square inch.
.....	600	.0094	.0026	
.....	.....	.....	.0018	Set after resting 1 hour.
.....	600	.0088	.0018	
235,137	2,100	.0305	.....	Snapping sound.
246,334	2,200	.0320	.....	
257,531	2,300	.0340	.....	
268,728	2,400	.0355	.....	
279,925	2,500	.0373	.0038	E (2,000-2,500)=3,472,000 pounds per square inch.
.....	600	.0108	.0035	
.....	600	.0108	.0035	
291,122	2,600	.0397	.....	
302,319	2,700	.0426	.....	
313,516	2,800	.0444	.....	
324,713	2,900	.0470	.....	
335,910	3,000	.0490	.0062	E (2,500-3,000)=2,688,000 pounds per square inch.
.....	600	.0144	.0060	
.....	600	.0142	.0060	
347,107	3,100	.0524	.....	
358,304	3,200	.0540	.....	Cracks near upper end of column.
369,501	3,300	.0561	.....	
380,698	3,400	.0575	.....	
391,895	3,500	.0590	.0081	E (3,000-3,500)=3,086,000 pounds per square inch.
.....	600	.0172	.0088	
.....	600	.0171	.0088	
650,000	5,805	.....	.....	Ultimate strength.

Column failed at the upper end.

Diameter of concrete inside the helix, at upper end of column, 10″.35=84.13 square inches sectional area. Load per square inch at time of maximum stress, referred to area within helix, 7,726 pounds.

TABULATION OF COMPRESSIVE STRENGTH OF CONCRETE AND MORTAR COLUMNS, PLAIN AND REËNFORCED.

Height of columns, 8 feet, approximately.

No. of test.	Diameter of column.	Composition.				Age.		Reënforcing metal.		Sectional areas.			Weight of concrete or mortar per cubic foot.	Compressive strength.	
		Cement.	Sand.	Stone or cinder.	Kind of stone or cinder.	Mos.	Days.	Description.	Metal in longitudinal bars.	Gross.	Concrete or mortar.	Bars.		Total.	Per square inch on gross sectional area.
	Inches.								*Per ct.*	*Sq. in.*	*Sq. in.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*
1809	12 ×12.05	1	0	1	Crusher dust	8	19	None	None.	144.60	144.60	0.	135.1	514,000	3,555
1799	12 ×12.04	1	0	2	.....do	7	26	.....do	None.	144.48	144.48	0.	137.2	408,000	2,824
1794	12.03×12.05	1	0	3	.....do	7	23	.....do	None.	144.96	144.96	0.	134.9	281.000	1,938
1798	12 ×12.20	1	0	4	.....do	7	25	.....do	None.	146.40	146.40	0.	133.3	213,300	1,427
1797	12 ×12.04	1	0	5	.....do	7	24	.....do	None.	144.48	144.48	0.	131.2	161,400	1,117
1793	12.07×12.02	1	0	6	.....do	7	16	.....do	None.	145.08	145.08	0.	132.7	121,000	834
1796	12 ×12.06	1	0	7	.....do	7	17	.....do	None.	144.72	144.72	0.	132.2	108,540	750
1792	12.03 × 12.04	1	0	8	.....do	7	14	.....do	None.	144.84	144.84	0.	131.7	101,100	697
1812	12.43 ×12.50	1	0	2	¼" to ½" trap rock	9	0	None	None.	155.38	155.38	0.	150.7	[a] 800,000	5,149
1788	12.35 ×12.50	1	0	3	.....do	8	5	.....do	None.	154.38	154.38	0.	149.4	389,000	2,520
1791	12.50 ×12.40	1	0	4	.....do	8	4	.....do	None.	155.00	155.00	0.	135.0	170,500	1,100
1790	12.47×12.49	1	0	1	¾" to 1½" trap rock	8	11	None	None.	155.75	155.75	0.	143.7	643,000	4,128
1813	12.45×12.52	1	0	1	.....do	9	9	.....do	None.	155.87	155.87	0.	145.7	792,000	5,081
1810	12.46×12.43	1	0	2	.....do	9	8	.....do	None.	154.88	154.88	0.	151.7	431,000	2,783
1811	12.47×12.49	1	0	2	.....do	9	11	.....do	None.	155.75	155.75	0.	152.5	528,000	3,390
1789	12.53×12.46	1	0	3	.....do	8	8	.....do	None.	156.12	156.12	0.	150.8	307,500	1,970
1802	12.18×12.03	1	0	2	Crusher dust, 1; ¼" to ½" trap rock, 1.	7	19	None	None.	156.52	156.52	0.	141.4	549,900	3,753
1801	12 ×12.12	1	0	4	Crusher dust, 2; ¼" to ½" trap rock, 2.	7	14	.....do	None.	145.44	145.44	0.	142.6	275,300	1,893
1795	12 ×12.08	1	0	6	Crusher dust, 3; ¼" to ½" trap rock, 3.	7	12	.....do	None.	144.96	144.96	0.	141.8	137,712	950
1800	12 ×12.08	1	0	8	Crusher dust, 4; ¼" to ½" trap rock, 4.	7	12	.....do	None.	144.96	144.96	0.	139.7	131,100	904
1808	12.07×12.10	1	0	1	Trap rock: ¼" to ½" ½; ½" to 1½", ½.	7	19	None	None.	146.05	146.05	0.	144.5	639,000	4,375
1807	12.03×12.06	1	0	2	Trap rock: ¼" to ½", 1; ½" to 1½", 1.	7	20	.....do	None.	145.08	145.08	0.	151.2	409,000	2,819
1806	11.95×12.10	1	0	3	Trap rock: ¼" to ½", 1½; ½" to 1½", 1½.	7	4	.....do	None.	144.60	144.60	0.	152.9	272,000	1,881

[a] Maximum load applied. Column not ruptured.

TABULATION OF COMPRESSIVE STRENGTH OF CONCRETE AND MORTAR COLUMNS, PLAIN AND REËNFORCED—Con.

No. of test.	Diameter of column.	Composition.				Age.		Reënforcing metal.		Sectional areas.			Weight of concrete or mortar per cubic foot.	Compressive strength.	
		Cement.	Sand.	Stone or cinder.	Kind of stone or cinder.	Mos.	Days.	Description.	Metal in longitudinal bars.	Gross.	Concrete or mortar.	Bars.		Total.	Per square inch on gross sectional area.
	Inches.								*Per ct.*	*Sq. in.*	*Sq. in.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*
1805	12.07×12.09	1	1	1	¼" to ½" trap rock	7	10	None	None.	145.92	145.92	0.	141.8	514,000	3,522
1804	11.98×12.09	1	2	2	do	7	8	do	None.	144.84	144.84	0.	142.0	192,000	1,326
1803	12.08×12.01	1	3	3	do	7	5	do	None.	145.08	145.08	0.	136.7	121,000	834
1773	10.37 diam.	Neat.	0	0	None	10	25	None	None.	84.46	84.46	0.	129.4	591,220	a 7,000
1774	10.37 diam.	1	½	3	¾" to 1½" trap rock	10	23	do	None.	84.46	84.46	0.	152.1	302,000	3,576
1775	11.97 diam.	1	2	4	do	10	22	do	None.	112.53	112.53	0.	152.6	270,072	2,400
1750	10.37 diam.	1	1	0	None	12	5	48 hoops 1".04 wide by ".06 thick, and 4 angles.	1.08	84.46	83.55	0.91	131.4	520,000	6,157
1748	10.40 diam.	1	1	2	¼" to ½" trap rock	12	3	do	1.07	84.95	84.04	0.91	146.9	479,000	5,639
1751	10.35 diam.	1	4	0	None	12	4	do	1.08	84.13	83.22	0.91	119.4	233,000	2,720
1749	10.09 diam.	1	4	8	¼" to ½" trap rock	12	4	do	1.14	79.88	78.97	0.91	144.4	215,000	2,602
1757	10.37 diam.	1	2	4	¾" to 1½" trap rock	11	24	2 hoops 1".04 wide by ".06 thick, and 4 angles.	1.08	84.46	83.55	0.91	148.4	133,800	1,584
1758	10.36 diam.	1	2	4	do	11	20	do	1.08	84.30	83.39	0.91	145.5	140,000	1,661
1756	10.38 diam.	1	2	4	do	11	25	5 hoops 1".04 wide by ".06 thick, and 4 angles.	1.08	84.62	83.71	0.91	149.1	135,392	1,600
1754	10.37 diam.	1	2	4	do	11	23	24 hoops 1".04 wide by ".06 thick.	None.	84.46	84.46	0.	147.9	186,000	2,206
1752	10.36 diam.	1	2	4	do	12	0	48 hoops 1".04 wide by ".06 thick.	None.	84.30	84.30	0.	150.3	262,000	3,108
1753	10.37 diam.	1	3	6	do	11	24	do	None.	84.46	84.46	0.	147.7	232,300	2,750
1765	11.99 diam.	1	3	6	do	14	14	25 hoops 1".50 wide by ".12 thick, and 4 angles.	0.81	112.91	112.00	0.91	148.4	288,000	2,551
1755	10.37 diam.	1	3	6	Cinders	12	0	25 hoops 1".04 wide by ".06 thick.	None.	84.46	84.46	0.	98.3	71,600	848
1784	12.38×12.60	1	2	4	¾" to 1½" trap rock	17	21	4 twisted steel bars, ¾" square, each.	1.44	155.99	153.74	2.25	150.1	358,777	2,300
1785	12.38×12.55	1	2	4	do	17	22	8 twisted steel bars, ¾" square, each.	2.90	155.37	150.87	4.50	151.3	574,869	3,700

1769	8.03× 8.07	1	2	4	¾" trap rock.....	11	0	Hennebique type; 4 longitudinal, hard steel bars, ¾" diameter each.	2.73	64.80	63.03	1.77	145.5	217,000	3,349
1770	8.02× 8.03	1	2	4	.....do.....	11	0	.....do.....	2.75	64.40	62.63	1.77	145.0	186,760	2,900
1771	8.02× 8.03	1	2	4	.....do.....	11	0	Hennebique type; 4 longitudinal, medium steel bars, ¾" diameter each.	2.75	64.40	62.63	1.77	144.7	157,600	2,438
1772	8.02× 8.03	1	2	4	.....do.....	11	0	.....do.....	2.75	64.40	62.63	1.77	146.4	167,440	2,600
1786	12.33×12.55	1	2	4	¾" to 1½" trap rock...	15	16	Hennebique type; 4 longitudinal, medium steel bars, 1½" diameter each.	2.57	154.74	150.76	3.98	152.2	491,000	3,173
1787	12.37×12.50	1	2	4	.....do.....	15	14	.....do.....	2.57	154.63	150.65	3.98	152.5	478,000	3,091
1776	8.74 diam.	1	2	0	None.....	9	20	Hennebique type; steel wire helix, ¼" wire, and 4 longitudinal steel bars ".62 diameter each.	2.02	59.99	58.78	1.21	127.2	172,000	2,857
1777	11.27 diam.	1	2	2	¾" trap rock.....	10	0	Hennebique type; steel wire helix, ".30 wire, and 4 longitudinal steel bars ".62 diameter each.	1.21	99.76	98.55	1.21	143.5	435,600	4,360
1778	11.94 diam.	1	2	2	.....do.....	10	14	Hennebique type; steel wire helix, $\frac{3}{16}$" wire, and 6 hard steel longitudinal bars, ".62 diameter each.	1.62	111.97	110.16	1.81	145.5	650,660	5,805

[a] Maximum load applied. Column not ruptured.

CONCRETE AND MORTAR COLUMNS.

Deduced Results on Reënforced Columns.

The following tables are deduced from the details of the tests, and show approximately the loads sustained by the concrete and by the steel reënforcing bars for columns of different mixtures, with different amounts of reënforcing metal and under different loads, the origin of the table being taken under the initial load of 100 pounds per square inch on the gross sectional area of each column.

The figures in the first five columns of each table are taken from the details of the tests. The loads in pounds per square inch of the second column refer to the gross sectional area of the concrete and steel taken together.

The stresses on the bars shown in the sixth and seventh columns of the tables are computed from the resilience on the gauged lengths, using a modulus of elasticity of 30,000,000 pounds per square inch for the steel. For example, the stress per square inch on the bars at 200 pounds per square inch on the gross sectional area of column No. 1613 is found to be $(30{,}000{,}000 \times ''.0009) \div 50 = 540$ pounds, which, multiplied by the sectional area of the bars, 2.31, gives the total load on them 1,247 pounds.

The figures in the eighth column, as indicated by the heading, are the differences between total loads on the column and those on the bars.

The several successive increments of load on the concrete appear in the next column.

In the tenth and eleventh columns are shown the relative loads on the concrete and bars expressed in percentages, and have the same relations as those which exist between the figures in the eighth and seventh columns.

The stresses per square inch on the concrete of the twelfth column are the quotients obtained from the figures of the eighth column divided by the net sectional area of the concrete. The ratios of stresses per square inch of the bars to the concrete are shown in the last column of each table.

These tables are reprinted from results in reports of 1904 and 1905, errors having been discovered in the original tables, which these are intended to take the place of.

CONCRETE COLUMN No. 1613.

1 : 1 : 2 Mixture. Pebbles. Reënforced with 4—¾″ twisted bars. Age, 8 months.

Sectional area of column, gross, 158.25 square inches; net, 155.94 square inches.

Sectional area of steel bars, 2.31 square inches.

See volume of 1904, page 389, for original table.

Applied loads.		On 50″ gauged length.			Computed stress on bars.		Stress on concrete by difference.	Increment on concrete.	Per cent of load on—		Stress per square inch on concrete.	Ratio, pounds per square inch, bars to concrete.
Total.	Per square inch.	Compression.	Set.	Resilience.	Per square inch.	Total.			Concrete.	Bars.		
Pounds.	*Lbs.*	*Inch.*	*Inch.*	*Inch.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*			*Lbs.*	
15,825	100	0.	0.	0.								
31,650	200	.0010	.0001	.0009	540	1,247	14,578	.....	92.1	7.9	93	5.8
47,475	300	.0021	.0004	.0017	1,020	2,356	29,294	14,716	92.6	7.4	188	5.4
63,300	400	.0040	.0010	.0030	1,800	4,158	43,317	14,023	91.2	8.8	278	6.5
79,125	500	.0063	.0017	.0046	2,760	6,376	56,924	13,607	89.9	10.1	365	7.6
94,950	600	.0087	.0028	.0059	3,540	8,177	70,948	14,024	89.7	10.3	455	7.8
110,775	700	.0109	.0031	.0078	4,680	10,811	84,139	13,191	88.6	11.4	540	8.7
126,600	800	.0124	.0037	.0087	5,220	12,058	98,717	14,578	89.1	10.9	633	8.2
142,425	900	.0145	.0043	.0102	6,120	14,137	112,463	13,746	88.8	11.2	721	8.5
158,250	1,000	.0169	.0050	.0119	7,140	16,493	125,932	13,469	88.4	11.6	808	8.8
174,075	1,100	.0195	.0054	.0141	8,460	19,543	138,707	12,775	87.6	12.4	889	9.5
189,900	1,200	.0219	.0058	.0161	9,660	22,315	151,760	13,053	87.2	12.8	973	9.9
205,725	1,300	.0239	.0060	.0179	10,740	24,809	165,091	13,331	86.9	13.1	1,059	10.1
221,550	1,400	.0261	.0065	.0196	11,760	27,166	178,559	13,468	86.8	13.2	1,145	10.3
237,375	1,500	.0281	.0068	.0213	12,780	29,522	192,028	13,469	86.7	13.3	1,231	10.4
253,200	1,600	.0303	.0071	.0232	13,920	32,155	205,220	13,192	86.3	13.7	1,316	10.6
269,025	1,700	.0323	.0075	.0248	14,880	34,373	218,827	13,607	86.4	13.6	1,403	10.6
284,850	1,800	.0344	.0078	.0266	15,960	36,868	232,157	13,330	86.3	13.7	1,489	10.7
300,675	1,900	.0370	.0082	.0288	17,280	39,917	244,933	12,776	86.0	14.0	1,571	11.0
316,500	2,000	.0392	.0086	.0306	18,360	42,412	258,263	13,330	85.9	14.1	1,656	11.1
430,000	2,720											
458,000	2,890	Ultimate strength.										

CONCRETE COLUMN No. 1612.

1 : 2 : 3 Mixture. Pebbles. Reënforced with 4—¾″ twisted steel bars. Age, 7 months 28 days.

Sectional area of column, gross, 160.40 square inches; net, 158.09 square inches.

Sectional area of bars, 2.31 square inches.

See volume of 1904, page 389, for original table.

Applied loads.		On 50″ gauged length.			Computed stress on bars.		Stress on concrete by difference.	Increment on concrete.	Per cent of load on—		Stress per square inch on concrete.	Ratio, pounds per square inch, bars to concrete.
Total.	Per square inch.	Compression.	Set.	Resilience.	Per square inch.	Total.			Concrete.	Bars.		
Pounds.	*Lbs.*	*Inch.*	*Inch.*	*Inch.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*			*Lbs.*	
16,040	100	0.	0.	0.								
32,080	200	.0025	.0005	.0020	1,200	2,772	13,268	.....	82.7	17.3	84	14.3
48,120	300	.0051	.0010	.0041	2,460	5,683	26,397	13,129	82.3	17.7	167	14.7
64,160	400	.0079	.0015	.0064	3,840	8,870	39,250	12,853	81.6	18.4	248	15.5
80,200	500	.0106	.0020	.0086	5,160	11,920	52,240	12,990	81.4	18.6	330	15.6
96,240	600	.0131	.0025	.0106	6,360	14,692	65,508	13,268	81.7	18.3	414	15.4
112,280	700	.0160	.0031	.0129	7,740	17,879	78,361	12,853	81.4	18.6	496	15.6
128,320	800	.0187	.0038	.0149	8,940	20,651	91,629	13,268	81.6	18.4	580	15.4
144,360	900	.0216	.0042	.0174	10,440	24,116	104,204	12,575	81.2	18.8	659	15.8
160,400	1,000	.0240	.0045	.0195	11,700	27,027	117,333	13,129	81.3	18.7	742	15.8
176,440	1,100	.0268	.0049	.0219	13,140	30,353	130,047	12,714	81.1	18.9	823	16.0
192,480	1,200	.0293	.0053	.0240	14,400	33,264	143,176	13,129	81.1	18.9	906	15.9
208,520	1,300	.0317	.0060	.0257	15,420	35,620	156,860	13,684	81.5	18.5	992	15.5
224,560	1,400	.0345	.0066	.0279	16,740	38,669	169,851	12,991	81.5	18.5	1,074	15.6
240,600	1,500	.0375	.0070	.0305	18,300	42,273	182,287	12,436	81.2	18.8	1,153	15.9
256,640	1,600	.0408	.0078	.0330	19,800	45,738	194,862	12,575	81.0	19.0	1,223	16.1
272,680	1,700	.0435	.0081	.0354	21,240	49,064	207,576	12,714	80.9	19.1	1,313	16.2
288,720	1,800	.0473	.0084	.0389	23,340	53,915	218,765	11,189	80.2	19.8	1,384	16.9
322,000	2,010	Ultimate strength.										

CONCRETE COLUMN No. 1580.

1 : 2 : 4 Mixture. Pebbles. Reënforced with 4—¾″ twisted bars. Age, 3 months 13 days.

Sectional area of column, gross, 157.62 square inches; net, 155.37 square inches.

Sectional area of steel bars, 2.25 square inches.

See volume of 1904, page 390, for original table.

Applied loads.		On 50″ gauged length.			Computed stress on bars.		Stress on concrete by difference.	Increment on concrete.	Per cent of load on—		Stress per square inch on concrete.	Ratio, pounds per square inch, bars to concrete.
Total.	Per square inch.	Compression.	Set.	Resilience.	Per square inch.	Total.			Concrete.	Bars.		
Pounds.	*Lbs.*	*Inch.*	*Inch.*	*Inch.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*			*Lbs.*	
15,762	100	0.	0.	0.								
31,524	200	.0017	0.	.0017	1,020	2,295	13,467	.....	85.4	14.6	87	11.7
47,286	300	.0042	.0004	.0038	2,280	5,130	26,394	12,927	83.7	16.3	170	13.4
63,048	400	.0066	.0007	.0059	3,540	7,965	39,321	12,927	83.2	16.8	253	14.0
78,810	500	.0090	.0013	.0077	4,620	10,395	52,653	13,332	83.5	16.5	339	13.6
94,572	600	.0114	.0017	.0097	5,820	13,095	65,715	13,062	83.4	16.6	423	13.8
110,334	700	.0141	.0020	.0121	7,260	16,335	78,237	12,522	82.7	17.3	504	14.4
126,096	800	.0172	.0028	.0144	8,640	19,440	90,894	12,657	82.4	17.6	585	14.8
141,858	900	.0191	.0035	.0156	9,360	21,060	105,036	14,142	83.3	16.7	676	13.8
157,620	1,000	.0216	.0044	.0172	10,320	23,220	118,638	13,602	83.6	16.4	764	13.5
189,144	1,200	.0264	.0054	.0210	12,600	28,350	145,032	26,394	83.6	16.4	933	13.5
236,430	1,500	.0380	.0079	.0301	18,060	40,635	180,033	35,001	81.6	18.4	1,159	15.6
267,954	1,700	.0483	.0098	.0385	23,100	51,975	200,217	20,184	79.4	20.6	1,289	17.9
299,478	1,900	.0641	.0130	.0511	30,660	68,985	214,731	14,514	75.7	24.3	1,382	22.2
313,000	1,990	Ultimate strength.										

CONCRETE COLUMN No. 1582.

1 : 2 : 4 Mixture. Pebbles. Reënforced with 4—$\frac{5}{8}$″ corrugated bars. Age, 3 months 16 days.

Sectional area of column, gross, 159.76 square inches; net, 158.21 square inches.

Sectional area of steel bars, 1.55 square inches.

See volume of 1904, page 390, for original table.

Applied loads.		On 50″ gauged length.			Computed stress on bars.		Stress on concrete by difference.	Increment on concrete.	Per cent of load on—		Stress per square inch on concrete.	Ratio, pounds per square inch, bars to concrete.
Total.	Per square inch.	Compression.	Set.	Resilience.	Per square inch.	Total.			Concrete.	Bars.		
Pounds.	*Lbs.*	*Inch.*	*Inch.*	*Inch.*	*Lbs.*	*Lbs.*	*Pounds.*	*Lbs.*			*Lbs.*	
15,976	100	0.	0.	0.								
31,952	200	.0018	.0001	.0017	1,020	1,581	14,395		90.1	9.9	91	11.2
47,928	300	.0039	.0005	.0034	2,040	3,162	28,790	14,395	90.1	9.9	182	11.2
63,904	400	.0067	.0019	.0048	2,880	4,464	43,464	14,674	90.7	9.3	275	10.5
95,856	600	.0111	.0027	.0084	5,040	7,812	72,068	28,604	90.2	9.8	456	11.1
127,808	800	.0158	.0034	.0124	7,440	11,532	100,300	28,232	89.7	10.3	634	11.7
159,760	1,000	.0210	.0046	.0164	9,840	15,252	128,532	28,232	89.4	10.6	812	12.1
191,712	1,200	.0266	.0060	.0206	12,360	19,158	156,578	28,046	89.1	10.9	990	12.5
239,640	1,500	.0364	.0087	.0277	16,620	25,761	197,903	41,325	88.5	11.5	1,251	13.3
271,592	1,700	.0448	.0110	.0338	20,280	31,434	224,182	26,279	87.7	12.3	1,417	14.3
319,520	2,000	.0614	.0157	.0457	27,420	42,501	261,043	36,861	86.0	14.0	1,650	16.6
349,000	2,180	Ultimate strength.										

CONCRETE COLUMN No. 1581.

1 : 2 : 4 Mixture. Pebbles. Reënforced with 4—$\frac{3}{4}$″ Thacher bars. Age, 3 months 14 days.

Sectional area of column, gross, 159.64 square inches; net, 157.99 square inches.

Sectional area of steel bars, mean, 1.65 square inches.

See volume of 1904, page 391, for original table.

Applied loads.		On 50″ gauged length.			Computed stress on bars.		Stress on concrete by difference.	Increment on concrete.	Per cent of load on—		Stress per square inch on concrete.	Ratio, pounds per square inch, bars to concrete.
Total.	Per square inch.	Compression.	Set.	Resilience.	Per square inch.	Total.			Concrete.	Bars.		
Pounds.	*Lbs.*	*Inch.*	*Inch.*	*Inch.*	*Lbs.*	*Lbs.*	*Pounds.*	*Lbs.*			*Lbs.*	
15,964	100	0.	0.	0.								
31,928	200	.0015	0.	.0015	900	1,485	14,479		90.7	9.3	92	9.8
47,892	300	.0038	.0004	.0034	2,040	3,366	28,562	14,083	89.5	10.5	181	11.3
63,856	400	.0060	.0008	.0052	3,120	5,148	42,744	14,182	89.3	10.7	270	11.6
95,784	600	.0107	.0015	.0092	5,520	9,108	70,712	27,968	88.6	11.4	448	12.3
127,712	800	.0152	.0023	.0129	7,740	12,771	98,977	28,265	88.6	11.4	626	12.4
159,640	1,000	.0208	.0034	.0174	10,440	17,266	126,410	27,433	88.0	12.0	800	13.1
191,568	1,200	.0260	.0048	.0212	12,720	20,988	154,616	28,206	88.0	12.0	979	13.0
239,460	1,500	.0350	.0068	.0282	16,920	27,918	195,578	40,962	87.5	12.5	1,238	13.7
271,388	1,700	.0434	.0088	.0346	20,760	34,254	221,170	25,592	86.6	13.4	1,400	14.8
303,316	1,900	.0550	.0124	.0426	25,560	42,174	245,178	24,008	85.3	14.7	1,552	16.5
318,000	1,990	Ultimate strength.										

CONCRETE COLUMN No. 1584.

1 : 2 : 4 Mixture. Pebbles. Reënforced with 8—⅝″ corrugated bars. Age, 3 months 14 days.

Sectional area of column, gross, 159.52 square inches; net, 156.43 square inches.

Sectional area of steel bars, mean, 3.09 square inches.

See volume of 1904, page 391, for original table.

Applied loads.		On 50″ gauged length.			Computed stress on bars.		Stress on concrete by difference.	Increment on concrete.	Per cent of load on—		Stress per square inch on concrete.	Ratio, pounds per square inch, bars to concrete.
Total.	Per square inch.	Compression.	Set.	Resilience.	Per square inch.	Total.			Concrete.	Bars.		
Pounds.	*Lbs.*	*Inch.*	*Inch.*	*Inch.*	*Lbs.*	*Lbs.*	*Pounds.*	*Lbs.*			*Lbs.*	
15,952	100	0.	0.	0.								
31,904	200	.0015	.0002	.0013	780	2,410	13,542	.....	84.9	15.1	87	9.0
47,856	300	.0032	.0005	.0027	1,620	5,006	26,898	13,356	84.3	15.7	172	9.4
63,808	400	.0048	.0007	.0041	2,460	7,601	40,255	13,357	84.1	15.9	257	9.6
95,712	600	.0083	.0011	.0072	4,320	13,349	66,411	26,156	83.3	16.7	425	10.2
127,616	800	.0117	.0016	.0101	6,060	18,725	92,939	26,528	83.2	16.8	594	10.2
159,520	1,000	.0156	.0022	.0134	8,040	24,844	118,724	25,785	82.7	17.3	759	10.6
191,424	1,200	.0193	.0028	.0165	9,900	30,591	144,881	26,157	82.6	17.4	926	10.7
239,280	1,500	.0255	.0039	.0216	12,960	40,046	183,282	38,401	82.1	17.9	1,172	11.0
271,184	1,700	.0298	.0048	.0250	15,000	46,350	208,882	25,600	81.8	18.2	1,335	11.2
319,040	2,000	.0376	.0062	.0314	18,840	58,216	244,872	35,990	80.8	19.2	1,565	12.0
398,800	2,500	.0522	.0083	.0439	26,340	81,391	301,457	56,585	78.7	21.3	1,927	13.7
452,000	2,830	Ultimate strength.										

CONCRETE COLUMN No. 1579.

1 : 2 : 4 Mixture. Pebbles. Reënforced with 8—¾″ Thacher bars. Age, 3 months 12 days.

Sectional area of column, gross, 158.50 square inches; net, 155.19 square inches.

Sectional area of steel bars, mean, 3.31 square inches.

See volume of 1904, page 392, for original table.

Applied loads.		On 50″ gauged length.			Computed stress on bars.		Stress on concrete by difference.	Increment on concrete.	Per cent of load on—		Stress per square inch on concrete.	Ratio, pounds per square inch, bars to concrete.
Total.	Per square inch.	Compression.	Set.	Resilience.	Per square inch.	Total.			Concrete.	Bars.		
Pounds.	*Lbs.*	*Inch.*	*Inch.*	*Inch.*	*Lbs.*	*Lbs.*	*Pounds.*	*Lbs.*			*Lbs.*	
15,850	100	0.	0.	0.								
31,700	200	.0009	0.	.0009	540	1,787	14,063	.....	88.7	11.3	91	5.9
47,550	300	.0021	0.	.0021	1,260	4,171	27,529	13,466	86.8	13.2	177	7.1
63,400	400	.0035	.0001	.0034	2,040	6,752	40,798	13,269	85.8	14.2	263	7.8
79,250	500	.0049	.0001	.0048	2,880	9,533	53,867	13,069	85.0	15.0	347	8.3
95,100	600	.0065	.0002	.0063	3,780	12,512	66,738	12,871	84.2	15.8	430	8.8
110,950	700	.0081	.0004	.0077	4,620	15,292	79,808	13,070	83.9	16.1	514	9.0
126,800	800	.0097	.0004	.0093	5,580	18,470	92,480	12,672	83.4	16.6	596	9.4
142,650	900	.0112	.0005	.0107	6,420	21,250	105,550	13,070	83.2	16.8	680	9.4
158,500	1,000	.0128	.0006	.0122	7,320	24,229	118,421	12,871	83.0	17.0	763	9.6
174,350	1,100	.0145	.0007	.0138	8,280	27,407	131,093	12,672	82.7	17.3	845	9.8
190,200	1,200	.0164	.0009	.0155	9,300	30,783	143,567	12,474	82.3	17.7	925	10.1
206,050	1,300	.0181	.0010	.0171	10,260	33,961	156,239	12,672	82.1	17.9	1,007	10.2
237,750	1,500	.0216	.0013	.0203	12,180	40,316	181,584	25,345	81.8	18.2	1,170	10.4
269,450	1,700	.0255	.0016	.0239	14,340	47,465	205,135	24,551	81.3	18.7	1,328	10.8
301,150	1,900	.0297	.0021	.0276	16,560	54,814	230,986	24,351	80.8	19.2	1,485	11.2
317,000	2,000	.0320	.0024	.0296	17,760	58,786	242,864	11,878	80.5	19.5	1,562	11.4
380,400	2,400	.0411	.0035	.0376	22,560	74,674	289,876	47,512	79.5	20.5	1,868	12.1
412,100	2,600	.0484	.0047	.0437	26,220	86,788	309,462	19,586	78.1	21.9	1,994	13.1
438,000	2,760	Ultimate strength.										

CONCRETE COLUMN No. 1610.

1 : 2 : 4 Mixture. Pebbles. Reënforced with 4—¾″ twisted steel bars. Age, 7 months 26 days.

Sectional area of column, gross, 159.39 square inches; net, 157.08 square inches.

Sectional area of steel bars, 2.31 square inches.

See volume of 1904, page 392, for original table.

Applied loads.		On 50″ gauged length.			Computed stress on bars.		Stress on concrete by difference.	Increment on concrete.	Per cent of load on—		Stress per square inch on concrete.	Ratio, pounds per square inch, bars to concrete.
Total.	Per square inch.	Compression.	Set.	Resilience.	Per square inch.	Total.			Concrete.	Bars.		
Pounds.	*Lbs.*	*Inch.*	*Inch.*	*Inch.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*			*Lbs.*	
15,939	100	0.	0.	0.								
31,878	200	.0015	.0002	.0013	780	1,802	14,137		88.7	11.3	90	8.7
47,818	300	.0032	.0004	.0028	1,680	3,881	27,997	13,860	87.8	12.2	178	9.4
63,757	400	.0053	.0007	.0046	2,760	6,376	41,442	13,445	86.7	13.3	264	10.5
79,696	500	.0074	.0008	.0066	3,960	9,148	54,609	13,167	85.7	14.3	348	11.4
95,635	600	.0097	.0010	.0087	5,220	12,058	67,638	13,029	84.9	15.1	431	12.1
111,574	700	.0119	.0012	.0107	6,420	14,830	80,805	13,167	84.5	15.5	514	12.5
127,514	800	.0144	.0015	.0129	7,740	17,879	93.695	12,890	84.0	16.0	596	13.0
143,453	900	.0169	.0019	.0150	9,000	20,790	108,724	13,029	83.7	16.3	679	13.3
159,392	1,000	.0195	.0023	.0172	10,320	23,839	119,614	12,890	83.4	16.6	761	13.6
175,331	1,100	.0219	.0028	.0191	11,460	26,473	132,919	13,305	83.4	16.6	846	13.5
191,270	1,200	.0246	.0031	.0215	12,900	29,799	145,532	12,613	83.0	17.0	926	13.9
239,088	1,500	.0319	.0042	.0277	16,620	38,392	184,757	39,225	82.8	17.2	1,176	14.1
289,800	1,820	Ultimate strength.										

CONCRETE COLUMN No. 1616.

1 : 2 : 4 Mixture. Cinders. Reënforced with 4—¾″ twisted bars. Age, 5 months 16 days.

Sectional area of column, gross, 159.39 square inches; net, 157.08 square inches.

Sectional area of bars, 2.31 square inches.

See volume of 1904, page 393, for original table.

Applied loads.		On 50′ gauged length.			Computed stress on bars.		Stress on concrete by difference.	Increment on concrete.	Per cent of load on—		Stress per square inch on concrete.	Ratio, pounds per square inch, bars to concrete.
Total.	Per square inch.	Compression.	Set.	Resilience.	Per square inch.	Total.			Concrete.	Bars.		
Pounds.	*Lbs.*	*Inch.*	*Inch.*	*Inch.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*			*Lbs.*	
15,939	100	0.	0.	0.								
31,878	200	.0029	0.	.0029	1,740	4,019	11,920		74.8	25.2	76	22.9
47,817	300	.0059	.0002	.0057	3,420	7,900	23,978	12,058	75.2	24.8	153	22.4
63,756	400	.0093	.0005	.0088	5,280	12,197	35,620	11,642	74.5	25.5	227	23.3
79,695	500	.0127	.0008	.0119	7,140	16,493	47,263	11,643	74.1	25.9	301	23.7
95,634	600	.0161	.0010	.0151	9,060	20,929	58,766	11,503	73.7	26.3	374	24.2
127,512	800	.0233	.0016	.0217	13,020	30,076	81,497	22,731	73.0	27.0	519	25.1
159,390	1,000	.0305	.0021	.0284	17,040	39,362	104,089	22,592	72.6	27.4	663	25.7
191,268	1,200	.0381	.0029	.0352	21,120	48,787	126,542	22,453	72.2	27.8	806	26.2
207,207	1,300	.0424	.0034	.0390	23,400	54,054	137,214	10,672	71.7	28.3	874	26.8
239,085	1,500	.0503	.0041	.0462	27,720	64,033	159,113	21,899	71.3	28.7	1,013	27.4
270,963	1,700	.0591	.0053	.0538	32,280	74,567	180,457	21,344	70.8	29.2	1,149	28.1
286,902	1,800	.0635	.0056	.0579	34,740	80,249	190,714	10,257	70.4	29.6	1,214	28.6
334,000	2,095	Ultimate strength.										

CONCRETE COLUMN No. 1608.

1 : 3 : 6 Mixture. Pebbles. Reënforced with 4—$\frac{3}{4}$″ twisted bars. Age, 7 months 24 days.

Sectional area of column, gross, 160.00 square inches; net, 157.69 square inches.

Sectional area of steel bars, 2.31 square inches.

See volume of 1904, page 393, for original table.

Applied loads.		On 50″ gauged length.			Computed stress on bars.		Stress on concrete by difference.	Increment on concrete.	Per cent of load on—		Stress per square inch on concrete.	Ratio, pounds per square inch, bars to concrete.
Total.	Per square inch.	Compression.	Set.	Resilience.	Per square inch.	Total.			Concrete.	Bars.		
Pounds.	*Lbs.*	*Inch.*	*Inch.*	*Inch.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*			*Lbs.*	
16,000	100	0.	0.	0.								
32,000	200	.0047	.0009	.0038	2,280	5,267	10,733	.....	67.1	32.9	68	33.5
48,000	300	.0093	.0019	.0074	4,440	10,256	21,744	11,011	68.0	32.0	138	32.4
64,000	400	.0138	.0027	.0111	6,660	15,385	32,615	10,871	67.9	32.1	207	32.2
80,000	500	.0179	.0033	.0146	8,760	20,236	43,764	11,149	68.4	31.6	278	31.5
96,000	600	.0223	.0038	.0185	11,100	25,641	54,359	10,595	67.9	32.1	345	32.2
112,000	700	.0274	.0044	.0230	13,800	31,878	64,122	9,763	66.8	33.2	407	33.9
128,000	800	.0322	.0049	.0273	16,390	37,838	74,162	10,040	66.2	33.8	470	34.9
144,000	900	.0380	.0055	.0325	19,500	45,045	82,955	8,793	64.8	35.2	526	37.1
160,000	1,000	.0441	.0063	.0378	22,680	52,391	91,609	8,654	63.6	36.4	581	39.0
218,600	1,370	Ultimate strength.										

CONCRETE COLUMN No. 1617.

1 : 3 : 6 Mixture. Trap rock. Reënforced with 8—$\frac{3}{4}$″ corrugated bars. Age, 5 months 10 days.

Sectional area of column, gross, 159.39 square inches; net, 156.30 square inches.

Sectional area of steel bars, mean, 3.09 square inches.

See volume of 1904, page 394, for original table.

Applied loads.		On 50′ gauged length.			Computed stress on bars.		Stress on concrete by difference.	Increment on concrete.	Per cent of load on—		Stress per square inch on concrete.	Ratio, pounds per square inch, bars to concrete.
Total.	Per square inch.	Compression.	Set.	Resilience.	Per square inch.	Total.			Concrete.	Bars.		
Pounds.	*Lbs.*	*Inch.*	*Inch.*	*Inch.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*			*Lbs.*	
15,939	100	0.	0.	0.								
31,878	200	.0013	0.	.0013	780	2,410	13,529	.....	84.9	15.1	87	9.0
47,817	300	.0031	.0002	.0029	1,740	5,377	26,501	12,972	83.1	16.9	170	10.2
63,756	400	.0049	.0005	.0044	2,640	8,158	39,659	13,158	82.9	17.1	254	10.4
79,695	500	.0069	.0006	.0063	3,780	11,680	52,076	12,417	81.7	18.3	333	11.4
95,634	600	.0090	.0009	.0081	4,860	15,017	64,678	12,602	81.2	18.8	414	11.7
127,512	800	.0134	.0015	.0119	7,140	22,063	89,510	24,832	80.2	19.8	573	12.5
143,451	900	.0158	.0019	.0139	8,340	25,771	101,741	12,231	79.8	20.2	651	12.8
159,390	1,000	.0185	.0023	.0162	9,720	30,035	113,416	11,675	79.1	20.9	726	13.4
191,268	1,200	.0239	.0033	.0206	12,360	38,192	137,137	23,721	78.2	21.8	877	14.1
207,207	1,300	.0268	.0037	.0231	13,860	42,827	148,441	11,304	77.6	22.4	950	14.6
223,146	1,400	.0300	.0041	.0259	15,540	48,019	159,188	10,747	76.8	23.2	1,018	15.3
239,085	1,500	.0337	.0048	.0289	17,340	53,581	169,565	10,377	76.0	24.0	1,085	16.0
255,024	1,600	.0371	.0049	.0322	19,320	59,699	179,386	9,821	75.0	25.0	1,148	16.8
270,963	1,700	.0409	.0055	.0354	21,240	65,632	189,392	10,006	74.3	25.7	1,212	17.5
286,902	1,800	.0449	.0062	.0387	23,220	71,750	199,213	9,821	73.5	26.5	1,275	18.2
302,841	1,900	.0493	.0065	.0428	25,680	79,351	207,551	8,338	72.3	27.7	1,328	19.3
318,780	2,000	.0540	.0069	.0471	28,260	87,323	215,518	7,967	71.2	28.8	1,379	20.5
365,000	2,290	Ultimate strength.										

CONCRETE COLUMN NO. 1673.

1:2 Mixture. Reënforced with 8—¾″ twisted steel bars. Age, 5 months 10 days.

Sectional area of column, gross, 158.13 square inches; net, 153.63 square inches.

Sectional area of steel bars, 4.50 square inches.

See volume of 1905, page 380, for original table.

Applied loads.		On 50″ gauged length.			Computed stress on bars.		Stress on concrete by difference.	Increment on concrete.	Per cent of load on—		Stress per square inch on concrete.	Ratio, pounds per square inch bars to concrete.
Total.	Per square inch.	Compression.	Set.	Resilience.	Per square inch.	Total.			Concrete.	Bars.		
Lbs.	*Lbs.*	*Inch.*	*Inch.*	*Inch.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*			*Lbs.*	
15,813	100	0.	0.	0.								
31,626	200	.0022	.0003	.0019	1,140	5,130	10,683		67.6	32.4	70	16.3
47,439	300	.0046	.0005	.0041	2,460	11,070	20,556	9,873	65.0	35.0	134	18.4
63,252	400	.0069	.0007	.0062	3,720	16,740	30,699	10,143	64.7	35.3	200	18.6
79,065	500	.0094	.0009	.0085	5,100	22,950	40,702	9,003	63.7	36.3	262	19.5
94,878	600	.0118	.0010	.0108	6,480	29,160	49,005	9,003	63.1	36.9	325	19.9
110,691	700	.0140	.0012	.0128	7,680	34,560	60,318	10,413	63.6	36.4	393	19.5
126,504	800	.0162	.0013	.0149	8,940	40,230	70,461	10,143	63.7	36.3	459	19.5
142,317	900	.0184	.0015	.0169	10,140	45,630	80,874	10,413	63.9	36.1	526	19.3
158,130	1,000	.0204	.0016	.0188	11,280	50,760	91,557	10,683	64.3	35.7	596	18.9
173,943	1,100	.0225	.0019	.0206	12,360	55,620	102,510	10,953	64.8	35.2	667	18.5
189,756	1,200	.0247	.0020	.0227	13,620	61,290	112,653	10,143	64.8	35.2	733	18.6
205,569	1,300	.0265	.0021	.0244	14,640	65,880	123,876	11,223	65.3	34.7	806	18.2
221,382	1,400	.0283	.0023	.0260	15,600	70,200	135,369	11,493	65.9	34.1	881	17.7
237,195	1,500	.0306	.0025	.0281	16,860	75,870	145,512	10,143	65.7	34.3	947	17.8
253,008	1,600	.0326	.0026	.0300	18,000	81,000	156,195	10,683	65.9	34.1	1,017	17.7
268,821	1,700	.0344	.0028	.0316	18,960	85,320	167,688	11,493	66.3	33.7	1,092	17.4
284,634	1,800	.0364	.0030	.0334	20,040	90,180	178,641	10,953	66.5	33.5	1,163	17.2
300,447	1,900	.0385	.0032	.0353	21,180	95,310	189,324	10,683	66.5	33.5	1,232	17.2
316,260	2,000	.0404	.0034	.0370	22,200	99,900	200,547	11,223	66.7	33.3	1,305	17.0
332,073	2,100	.0424	.0035	.0389	23,340	105,030	211,230	10,683	66.8	33.2	1,375	17.0
347,886	2,200	.0446	.0038	.0408	24,480	110,160	221,913	10,683	66.8	33.2	1,444	17.0
363,699	2,300	.0466	.0040	.0426	25,560	115,020	232,866	10,953	66.9	33.1	1,516	16.9
379,512	2,400	.0486	.0040	.0446	26,760	120,420	243,279	10,413	66.9	33.1	1,584	16.9
395,325	2,500	.0508	.0044	.0464	27,840	125,280	254,232	10,953	67.0	33.0	1,655	16.8
411,138	2,600	.0530	.0045	.0485	29,100	130,950	264,375	10,143	66.9	33.1	1,721	16.9
426,951	2,700	.0551	.0047	.0504	30,240	136,080	275,058	10,683	66.9	33.1	1,790	16.9
442,764	2,800	.0574	.0050	.0524	31,440	141,480	285,471	10,413	66.9	33.1	1,858	16.9
458,577	2,900	.0598	.0053	.0545	32,700	147,150	295,614	10,143	66.8	33.2	1,924	17.0
474,390	3,000	.0622	.0055	.0567	34,020	153,090	305,487	9,873	66.6	33.4	1,988	17.1
490,203	3,100	.0651	.0056	.0595	35,700	160,650	313,740	8,253	66.1	33.9	2,042	17.5
506,016	3,200	.0679	.0061	.0618	37,080	166,860	323,343	9,603	66.0	34.0	2,105	17.6
521,829	3,300	.0702	.0064	.0638	38,280	172,260	333,756	10,413	66.0	34.0	2,172	17.6
537,642	3,400	.0730	.0071	.0659	39,540	177,930	343,899	10,143	65.9	34.1	2,238	17.7
553,455	3,500	.0762	.0074	.0688	41,280	185,760	351,882	7,983	65.4	34.6	2,290	18.0
569,268	3,600	.0793	.0080	.0713	42,780	192,510	360,945	9,063	65.2	34.8	2,349	18.2
585,081	3,700	.0830	.0086	.0744	44,640	200,880	368,388	7,443	64.7	35.3	2,398	18.6
600,894	3,800	.0871	.0099	.0772	46,320	208,440	376,641	8,253	64.4	35.6	2,452	18.9
616,707	3,900	.0910	.0105	.0805	48,300	217,350	383,544	6,903	63.8	36.2	2,497	19.3
632,520	4,000	.0952	.0124	.0828	49,680	223,560	393,147	9,603	63.7	36.3	2,559	19.4
648,333	4,100	.0997	.0143	.0854	51,240	230,580	401,940	8,793	63.5	36.5	2,616	19.6
664,146	4,200	Ultimate strength.										

CONCRETE COLUMN No. 1690.

1:3 Mixture. Reënforced with 8—¾″ twisted steel bars. Age, 7 months 21 days.

Sectional area of column, gross, 157.00 square inches; net, 152.50 square inches.

Sectional area of steel bars, 4.50 square inches.

See volume of 1905, page 381, for original table.

Applied loads.		On 50″ gauged length.			Computed stress on bars.		Stress on concrete by difference.	Increment on concrete.	Per cent of load on—		Stress per square inch on concrete.	Ratio, pounds per square inch bars to concrete.
Total.	Per square inch.	Compression.	Set.	Resilience.	Per square inch.	Total.			Concrete.	Bars.		
Lbs.	*Lbs.*	*Inch.*	*Inch.*	*Inch.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*			*Lbs.*	
15,700	100	0.	0.	0.								
31,400	200	.0021	.0001	.0020	1,200	5,400	10,300		65.6	34.4	68	17.6
47,100	300	.0044	.0003	.0041	2,460	11,070	20,330	10,030	64.7	35.3	133	18.5
62,800	400	.0071	.0005	.0066	3,960	17,820	29,280	8,950	62.2	37.8	192	20.6
78,500	500	.0096	.0008	.0088	5,280	23,760	39,040	9,760	62.2	37.8	256	20.6
94,200	600	.0120	.0009	.0111	6,660	29,970	48,530	9,490	61.8	38.2	318	20.9
109,900	700	.0143	.0010	.0133	7,980	35,910	58,290	9,760	61.9	38.1	382	20.9
125,600	800	.0167	.0011	.0156	9,360	42,120	67,780	9,490	61.7	38.3	444	21.1
141,300	900	.0189	.0013	.0176	10,560	47,520	78,080	10,300	62.2	37.8	512	20.6
157,000	1,000	.0211	.0014	.0197	11,820	53,190	88,110	10,030	62.4	37.6	578	20.4
172,700	1,100	.0232	.0015	.0217	13,020	58,590	98,410	10,300	62.7	37.3	645	20.2
188,400	1,200	.0253	.0016	.0237	14,220	63,990	108,710	10,300	62.9	37.1	713	19.9
204,100	1,300	.0275	.0018	.0257	15,420	69,390	119,010	10,300	63.2	36.8	780	19.8
219,800	1,400	.0298	.0020	.0278	16,680	75,060	129,040	10,030	63.2	36.8	846	19.7
235,500	1,500	.0320	.0021	.0299	17,940	80,730	139,070	10,030	63.3	36.7	912	19.7
251,200	1,600	.0343	.0025	.0318	19,080	85,860	149,640	10,570	63.5	36.5	981	19.4
266,900	1,700	.0364	.0027	.0337	20,220	90,990	160,210	10,570	63.8	36.2	1,051	19.2
282,600	1,800	.0388	.0030	.0358	21,480	96,660	170,240	10,030	63.8	36.2	1,116	19.2
298,300	1,900	.0411	.0032	.0379	22,740	102,330	180,270	10,030	63.8	36.2	1,182	19.2
314,000	2,000	.0433	.0035	.0398	23,880	107,460	190,840	10,570	64.0	36.0	1,251	19.1
329,700	2,100	.0458	.0038	.0420	25,200	113,400	200,600	9,760	63.9	36.1	1,315	19.2
345,400	2,200	.0480	.0040	.0440	26,400	118,800	210,900	10,300	64.0	36.0	1,383	19.1
361,100	2,300	.0505	.0044	.0461	27,660	124,470	220,930	10,030	64.0	36.0	1,449	19.1
376,800	2,400	.0534	.0047	.0487	29,220	131,490	229,610	8,680	63.6	36.4	1,506	19.4
392,500	2,500	.0561	.0050	.0511	30,660	137,970	238,830	9,220	63.4	36.6	1,566	19.6
408,200	2,600	.0589	.0055	.0534	32,040	144,180	248,320	9,490	63.3	36.7	1,628	19.7
603,000	3,841	Ultimate strength.										

CONCRETE COLUMN NO. 1691.

1:4 Mixture. Reënforced with 8—¾″ steel bars. Age, 7 months 25 days.

Sectional area of column, gross, 157.25 square inches; net, 152.75 square inches.

Sectional area of steel bars, 4.50 square inches.

See volume of 1905, page 382, for original table.

Applied loads.		On 50″ gauged length.			Computed stress on bars.		Stress on concrete by difference.	Increment on concrete.	Per cent of load on—		Stress per square inch on concrete.	Ratio, pounds per square inch bars to concrete.
Total.	Per square inch.	Compression.	Set.	Resilience.	Per square inch.	Total.			Concrete.	Bars.		
Lbs.	*Lbs.*	*Inch.*	*Inch.*	*Inch.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*			*Lbs.*	
15,725	100	0.	0.	0.								
31,450	200	.0030	.0002	.0028	1,680	7,560	8,165		51.9	48.1	53	31.7
47,175	300	.0069	.0005	.0064	3,840	17,280	14,170	6,005	45.1	54.9	93	41.3
62,900	400	.0104	.0008	.0096	5,760	25,920	21,255	7,085	45.1	54.9	139	41.4
78,625	500	.0138	.0009	.0129	7,740	34,830	28,070	6,815	44.6	55.4	184	42.1
94,350	600	.0169	.0010	.0159	9,540	42,930	35,695	7,625	45.4	54.6	234	40.8
110,075	700	.0198	.0011	.0187	11,220	50,490	43,860	8,165	46.5	53.5	287	39.1
125,800	800	.0223	.0012	.0211	12,660	56,970	53,105	9,245	48.2	51.8	348	36.4
141,525	900	.0248	.0015	.0233	13,980	62,910	62,890	9,785	50.0	50.0	412	33.9
157,250	1,000	.0272	.0015	.0257	15,420	69,390	72,135	9,245	51.0	49.0	472	32.7
172,975	1,100	.0295	.0015	.0280	16,800	75,600	81,650	9,515	51.9	48.1	535	31.4
188,700	1,200	.0320	.0017	.0303	18,180	81,810	91,165	9,515	52.7	47.3	597	30.5
204,425	1,300	.0350	.0025	.0325	19,500	87,750	100,950	9,785	53.5	46.5	661	29.5
220,150	1,400	.0374	.0027	.0347	20,820	93,690	110,735	9,785	54.2	45.8	725	28.7
235,875	1,500	.0395	.0029	.0366	21,960	98,820	121,330	10,595	55.1	44.9	794	27.7
251,600	1,600	.0424	.0031	.0393	23,580	106,110	129,765	8,435	55.0	45.0	850	27.7
267,325	1,700	.0447	.0032	.0415	24,900	112,050	139,550	9,785	55.5	44.5	914	27.2
283,050	1,800	.0478	.0035	.0443	26,580	119,610	147,715	8,165	55.3	44.7	967	27.5
298,775	1,900	.0499	.0039	.0460	27,600	124,200	158,850	11,135	56.1	43.9	1,040	26.5
314,500	2,000	.0525	.0040	.0485	29,100	130,950	167,825	8,975	56.2	43.8	1,099	26.5
330,225	2,100	.0547	.0040	.0507	30,420	136,890	177,610	9,785	56.5	43.5	1,163	26.2
345,950	2,200	.0578	.0043	.0535	32,100	144,450	185,775	8,165	56.3	43.7	1,216	26.4
361,675	2,300	.0606	.0045	.0561	33,660	151,470	194,480	8,705	56.2	43.8	1,273	26.4
377,400	2,400	.0635	.0046	.0589	35,340	159,030	202,645	8,165	56.0	44.0	1,327	26.6
393,125	2,500	.0665	.0050	.0615	36,900	166,050	211,350	8,705	56.0	44.0	1,384	26.7
531,100	3,377	Ultimate strength.										

CONCRETE COLUMN No. 1688.

1 : 5 Mixture. Reënforced with 8—¾″ twisted steel bars. Age, 6 months 17 days.

Sectional area of column, gross, 157.50 square inches; net, 153.00 square inches.

Sectional area of steel bars, 4.50 square inches.

See volume of 1905, page 383, for original table.

Applied loads.		On 50″ gauged length.			Computed stress on bars.		Stress on concrete by difference.	Increment on concrete.	Per cent of load on—		Stress per square inch on concrete.	Ratio pounds per square inch, bars to concrete.
Total.	Per square inch.	Compression.	Set.	Resilience.	Per square inch.	Total.			Concrete.	Bars.		
Lbs.	*Lbs.*	*Inch.*	*Inch.*	*Inch.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*			*Lbs.*	
15,750	100	0.	0.	0.								
31,500	200	.0035	0.	.0035	2,100	9,450	6,300		40.0	60.0	41	51.2
47,250	300	.0075	.0002	.0073	4,380	19,710	11,790	5,490	37.4	62.6	77	56.9
63,000	400	.0114	.0006	.0108	6,480	29,160	18,090	6,300	38.3	61.7	118	54.9
78,750	500	.0147	.0007	.0140	8,400	37,800	25,200	7,110	40.0	60.0	165	50.9
94,500	600	.0181	.0010	.0171	10,260	46,170	32,580	7,380	41.4	58.6	213	48.2
110,250	700	.0202	.0001	.0201	12,060	54,270	40,230	7,650	42.6	57.4	263	45.9
126,000	800	.0235	.0004	.0231	13,860	62,370	47,880	7,650	43.4	56.6	313	44.3
141,750	900	.0265	.0006	.0259	15,540	69,930	56,070	8,190	44.5	55.5	366	42.5
157,500	1,000	.0293	.0008	.0285	17,100	76,950	64,800	8,730	45.7	54.3	424	40.3
173,250	1,100	.0326	.0009	.0317	19,020	85,590	71,910	7,110	45.7	54.3	470	40.5
189,000	1,200	.0358	.0010	.0348	20,880	93,960	79,290	7,380	45.8	54.2	518	40.3
204,750	1,300	.0386	.0006	.0380	22,800	102,600	86,400	7,110	45.7	54.3	565	40.4
220,500	1,400	.0420	.0010	.0410	24,600	110,700	94,050	7,650	45.9	54.1	615	40.0
236,250	1,500	.0460	.0013	.0447	26,280	120,690	99,810	5,760	45.3	54.7	652	40.3
252,000	1,600	.0497	.0017	.0480	28,800	129,600	106,650	6,840	45.1	54.9	697	41.3
267,750	1,700	.0535	.0020	.0515	30,900	139,050	112,950	6,300	44.8	55.2	738	41.9
283,500	1,800	.0574	.0024	.0550	33,000	148,500	119,250	6,300	44.5	55.5	779	42.4
443,000	2,813	Ultimate strength.										

CONCRETE COLUMN No. 1689.

1 : 5 Mixture. Reënforced with 13—¾″ twisted steel bars. Age, 7 months 15 days.

Sectional area of column, gross, 157.75 square inches; net, 150.44 square inches.

Sectional area of steel bars, 7.31 square inches.

See volume of 1905, page 384, for original tables.

Applied loads.		On 50″ gauged length.			Computed stress on bars.		Stress on concrete by difference.	Increment on concrete.	Per cent of load on—		Stress per square inch on concrete.	Ratio, pounds per square inch, bars to concrete.
Total.	Per square inch.	Compression.	Set.	Resilience.	Per square inch.	Total.			Concrete.	Bars.		
Lbs.	*Lbs.*	*Inch.*	*Inch.*	*Inch.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*			*Lbs.*	
15,775	100	0.	0.									
31,550	200	.0024	.0002	.0022	1,320	9,649	6,126		38.8	61.2	41	32.2
47,325	300	.0050	.0004	.0046	2,760	20,176	11,374	5,248	36.1	63.9	76	36.3
63,100	400	.0080	.0005	.0075	4,500	32,895	14,430	3,056	30.5	69.5	96	46.9
78,875	500	.0109	.0007	.0102	6,120	44,737	18,363	3,933	29.1	70.9	122	50.2
94,650	600	.0137	.0009	.0128	7,680	56,141	22,734	4,371	28.8	71.2	151	50.9
110,425	700	.0163	.0009	.0154	9,240	67,544	27,106	4,372	28.6	71.4	180	51.3
126,200	800	.0190	.0011	.0179	10,740	78,509	31,916	4,810	28.9	71.1	212	50.9
141,975	900	.0215	.0012	.0203	12,180	89,036	37,164	5,248	29.4	70.6	247	49.3
157,750	1,000	.0240	.0013	.0227	13,620	99,562	42,413	5,249	29.9	70.1	282	48.3
173,525	1,100	.0263	.0014	.0249	14,940	109,211	48,539	6,126	30.8	69.2	323	46.3
189,300	1,200	.0289	.0014	.0275	16,500	120,615	52,910	4,371	30.5	69.5	352	46.9
205,075	1,300	.0312	.0016	.0296	17,760	129,826	59,474	6,564	31.4	68.6	395	45.0
220,850	1,400	.0335	.0017	.0318	19,080	139,475	65,600	6,126	32.0	68.0	436	43.8
236,625	1,500	.0357	.0017	.0340	20,400	149,124	71,726	6,126	32.5	67.5	477	42.8
252,400	1,600	.0381	.0019	.0362	21,720	158,773	77,852	6,126	32.9	67.1	517	42.0
268,175	1,700	.0403	.0020	.0383	22,980	167,984	84,416	6,564	33.4	66.6	561	41.0
283,950	1,800	.0428	.0021	.0407	24,420	178,510	89,665	5,249	33.4	66.6	596	41.0
299,725	1,900	.0451	.0021	.0430	25,800	188,398	95,352	5,687	33.6	66.4	634	40.7
315,500	2,000	.0476	.0022	.0454	27,240	199,124	100,601	5,249	33.6	66.4	669	40.7
331,275	2,100	.0499	.0022	.0477	28,620	209,212	106,288	5,687	33.7	66.3	707	40.5
347,050	2,200	.0526	.0024	.0502	30,120	220,177	111,098	4,810	33.5	66.5	738	40.8
362,825	2,300	.0551	.0024	.0527	31,620	231,142	115,908	4,810	33.4	66.6	770	41.0
378,600	2,400	.0576	.0025	.0551	33,060	241,069	121,156	5,248	33.4	66.6	805	41.1
394,375	2,500	.0602	.0025	.0577	34,620	253,072	125,528	4,372	33.2	66.8	834	41.5
410,150	2,600	.0630	.0027	.0603	36,180	264,476	129,899	4,371	32.9	67.1	863	41.9
425,925	2,700	.0655	.0028	.0627	37,620	275,002	135,148	5,249	33.0	67.0	898	41.9
441,700	2,800	.0684	.0030	.0654	39,240	286,844	139,081	3,933	32.7	67.3	924	42.5
616,000	3,905	Ultimate strength.										

CONCRETE COLUMN No. 1652.

1 : 2 : 4 Mixture. Cinders. Reënforced with 8—3″ twisted steel bars. Age, 5 months 5 days.

Sectional area of column, gross, 159.77 square inches; net, 155.27 square inches.

Sectional area of bars, 4.50 square inches.

See volume of 1905, page 385, for original table.

Applied loads.		On 50″ gauged length.			Computed stress on bars.		Stress on concrete by difference.	Increment on concrete.	Per cent of load on—		Stress per square inch on concrete.	Ratio, pounds per square inch, bars to concrete.
Total.	Per square inch.	Compression.	Set.	Resilience.	Per square inch.	Total.			Concrete.	Bars.		
Lbs.	*Lbs.*	*Inch.*	*Inch.*	*Inch.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*			*Lbs.*	
15,977	100	0.	0.	0.								
31,954	200	.0023	0.	.0023	1,380	6,210	9,767		61.1	38.9	63	21.9
47,931	300	.0049	.0004	.0045	2,700	12,150	19,804	10,037	62.0	38.0	128	21.1
63,908	400	.0080	.0006	.0074	4,440	19,980	27,951	8,147	58.3	41.7	180	24.7
79,885	500	.0111	.0008	.0103	6,180	27,810	36,098	8,147	56.5	43.5	232	26.6
95,862	600	.0142	.0012	.0130	7,800	35,100	44,785	8,687	56.1	43.9	288	27.1
111,839	700	.0176	.0015	.0161	9,660	43,470	52,392	7,607	54.7	45.3	337	28.7
127,816	800	.0210	.0018	.0192	11,520	51,840	59,999	7,607	53.6	46.4	386	29.8
143,793	900	.0241	.0020	.0221	13,260	59,670	68,146	8,147	53.3	46.7	439	30.2
159,770	1,000	.0275	.0023	.0252	15,120	68,040	75,753	7,607	52.7	47.3	488	31.0
175,747	1,100	.0310	.0028	.0282	16,920	76,140	83,630	7,877	52.3	47.7	539	31.4
191,724	1,200	.0343	.0028	.0315	18,900	85,050	90,697	7,067	51.6	48.4	584	32.4
207,701	1,300	.0376	.0030	.0346	20,760	93,420	98,304	7,607	51.3	48.7	633	32.8
223,678	1,400	.0410	.0032	.0378	22,680	102,060	105,641	7,337	50.9	49.1	680	33.4
239,655	1,500	.0445	.0034	.0411	24,660	110,970	112,708	7,067	50.4	49.6	726	34.0
255,632	1,600	.0483	.0037	.0446	26,760	120,420	119,235	6,527	49.8	50.2	768	34.8
271,609	1,700	.0520	.0038	.0482	28,920	130,140	125,492	6,257	49.1	50.9	808	35.8
287,586	1,800	.0552	.0040	.0512	30,720	138,240	133,369	7,877	49.1	50.9	859	35.8
303,563	1,900	.0590	.0042	.0548	32,880	147,960	139,026	6,257	48.6	51.4	899	36.6
319,540	2,000	.0626	.0043	.0583	34,980	157,410	146,153	6,527	48.1	51.9	941	37.2
335,517	2,100	.0676	.0047	.0629	37,740	169,830	149,710	3,557	46.9	53.1	964	39.1
351,494	2,200	.0714	.0050	.0664	39,840	179,280	156,237	6,527	46.6	53.4	1,006	39.6
367,471	2,300	.0749	.0050	.0699	41,940	188,730	162,764	6,527	46.3	53.7	1,048	40.0
383,448	2,400	.0793	.0056	.0737	44,220	198,990	168,481	5,717	45.8	54.2	1,085	40.8
399,425	2,500	.0838	.0060	.0778	46,680	210,060	173,388	4,907	45.2	54.8	1,117	41.8
415,402	2,600	.0888	.0064	.0824	49,400	222,480	176,945	3,557	44.3	55.7	1,140	43.4
484,000	3,029	Ultimate strength.										

CONCRETE COLUMN No. 1653.

1 : 3 : 6 Mixture. Cinders. Reënforced with 4—¾″ twisted steel bars.

Age, 5 months 5 days.

Sectional area of column, gross, 158.76 square inches; net, 156.51 square inches.

Sectional area of steel bars, 2.25 square inches.

See volume of 1905, page 386, for original tables.

Applied loads.		On 50″ gauged length.			Computed stress on bars.		Stress on concrete by difference.	Increment concrete.	Per cent of load on—		Stress per square inch on concrete.	Ratio, pounds per square inch, bars to concrete.
Total.	Per square inch.	Compression.	Set.	Resilience.	Per square inch.	Total.			Concrete.	Bars.		
Lbs.	*Lbs.*	*Inch.*	*Inch.*	*Inch.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*			*Lbs.*	
15,876	100	0.	0.	0.								
31,752	200	.0035	.0003	.0032	1,920	4,320	11,556	.....	72.8	27.2	74	25.9
47,628	300	.0076	.0008	.0068	4,080	9,180	22,572	11,016	71.1	28.9	144	28.3
63,504	400	.0124	.0012	.0112	6,720	15,120	32,508	9,936	68.3	31.7	208	32.3
79,380	500	.0169	.0017	.0152	9,120	20,520	42,984	10,476	67.7	32.3	275	33.2
95,256	600	.0218	.0023	.0195	11,700	26,325	53,055	10,071	66.8	33.2	339	34.5
111,132	700	.0276	.0036	.0240	14,400	32,400	62,856	9,801	66.0	34.0	402	35.8
127,008	800	.0327	.0041	.0286	17,160	38,610	72,522	9,666	65.3	34.7	463	37.1
142,884	900	.0380	.0048	.0332	19,920	44,820	82,188	9,666	64.7	35.3	525	37.9
158,760	1,000	.0444	.0054	.0390	23,400	52,650	90,234	8,046	63.2	36.8	576	40.6
174,636	1,100	.0493	.0059	.0434	26,040	58,590	100,170	9,936	63.1	36.9	640	40.7
190,512	1,200	.0550	.0067	.0483	28,980	65,205	109,431	9,261	62.7	37.3	699	41.5
206,388	1,300	.0606	.0071	.0535	32,100	72,225	118,287	8,856	62.1	37.9	756	42.5
222,264	1,400	.0674	.0081	.0593	35,580	80,055	126,333	8,046	61.2	38.8	807	44.1
238,140	1,500	.0746	.0093	.0653	39,180	88,155	134,109	7,776	60.3	39.7	857	45.7
254,016	1,600	.0823	.0108	.0715	42,900	96,525	141,615	7,506	59.5	40.5	905	47.4
269,892	1,700	.0906	.0128	.0778	46,680	105,030	148,986	7,371	58.7	41.3	952	49.0
285,768	1,800	.1006	.0157	.0849	50,940	114,615	155,277	6,291	57.5	42.5	992	51.4
306,700	1,932	Ultimate strength.										

CONCRETE COLUMN No. 1654.

1 : 3 : 6 Mixture. Cinders. Reënforced with 8—¾″ twisted steel bars.

Sectional area of column, gross, 159.01 square inches; net, 154.51 square inches.

Sectional area of steel bars, 4.50 square inches.

See volume of 1905, page 387, for original table.

Applied loads.		On 50″ gauged length.			Computed stress on bars.		Stress on concrete by difference.	Increment on concrete.	Per cent of load on—		Stress per square inch on concrete.	Ratio, pounds per square inch, bars to concrete.
Total.	Per square inch.	Compression.	Set.	Resilience.	Per quare inch.	Total.			Concrete.	Bars.		
Lbs.	*Lbs.*	*Inch.*	*Inch.*	*Inch.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*			*Lbs.*	
15,901	100	0.	0.	0.								
31,802	200	.0019	0.	.0019	1,140	5,130	10,771		67.7	32.3	70	16.3
47,703	300	.0044	0.	.0044	2,640	11,880	19,922	9,151	62.6	37.4	129	20.5
63,604	400	.0072	.0004	.0068	4,080	18,360	29,343	9,421	61.5	38.5	190	21.5
79,505	500	.0114	.0003	.0111	6,660	29,970	33,634	4,291	52.9	47.1	218	30.6
95,406	600	.0133	.0003	.0130	7,800	35,100	44,405	10,771	55.9	44.1	287	27.2
111,307	700	.0162	.0005	.0157	9,420	42,390	53,016	8,611	55.6	44.4	343	27.5
127,208	800	.0198	.0011	.0187	11,220	50,490	60,817	7,801	54.6	45.4	394	28.5
143,109	900	.0231	.0014	.0217	13,020	58,590	68,618	7,801	53.9	46.1	444	29.3
159,010	1,000	.0263	.0016	.0247	14,820	66,690	76,419	7,801	53.4	46.6	495	29.9
174,911	1,100	.0308	.0027	.0281	16,860	75,870	83,140	6,721	52.3	47.7	538	31.3
190,812	1,200	.0346	.0029	.0317	19,020	85,590	89,321	6,181	51.1	48.9	578	32.9
206,713	1,300	.0377	.0032	.0345	20,700	93,150	97,662	8,341	51.2	48.8	632	32.8
222,614	1,400	.0411	.0033	.0378	22,680	102,060	104,653	6,991	50.6	49.4	677	33.5
238,515	1,500	.0449	.0036	.0413	24,780	111,510	111,104	6,451	49.9	50.1	719	34.5
254,416	1,600	.0488	.0038	.0450	27,000	121,500	117,015	5,911	49.1	50.9	757	35.7
270,317	1,777	.0521	.0039	.0482	28,920	130,140	124,276	7,261	48.8	51.2	804	36.0
286,218	1,800	.0558	.0040	.0518	31,080	139,860	130,457	6,181	48.3	51.7	844	36.8
302,119	1,900	.0596	.0041	.0555	33,300	149,850	136,368	5,911	47.6	52.4	883	37.7
318,020	2,000	.0633	.0043	.0590	35,400	159,300	142,819	6,451	47.3	52.7	924	38.3
333,921	2,100	.0682	.0046	.0636	38,160	171,720	146,300	3,481	46.0	54.0	947	40.3
349,822	2,200	.0721	.0046	.0675	40,500	182,250	151,671	5,371	45.4	54.6	982	41.2
365,723	2,300	.0761	.0048	.0713	42,780	192,510	157,312	5,641	45.0	55.0	1,018	42.0
381,624	2,400	.0807	.0051	.0756	45,360	204,120	161,603	4,291	44.2	55.8	1,046	43.4
397,525	2,500	.0856	.0059	.0797	47,820	215,190	166,434	4,831	43.6	56.4	1,077	44.4
413,426	2,600	.0908	.0068	.0840	50,400	226,800	170,725	4,291	42.9	57.1	1,105	45.6
429,327	2,700	.0971	.0085	.0886	53,160	239,220	174,206	3,481	42.1	57.9	1,127	47.2
445,228	2,800	.1042	.0111	.0931	55,860	251,370	177,957	3,751	41.5	58.5	1,152	48.5
493,000	3,100	Ultimate strength.										

STEEL BARS USED IN CONCRETE CONSTRUCTION.

KAHN BARS FROM THE TRUSSED CONCRETE STEEL COMPANY, DETROIT, MICH.

TENSILE TESTS.

The following tensile specimens represent metal in bars for reënforcing concrete columns:

Size of bar represented.	Diameter.	Sectional area.	Elastic limit per square inch.	Tensile strength per square inch.	Elongation.	Contraction of area.	Elongation of inch sections.		Appearance.
Inch.	*Inch.*	*Sq. in.*	*Lbs.*	*Lbs.*	*Per ct.*	*Per ct.*	"	"	
½	.358	.10	45,200	65,200	44.0	62.0	.44*		Fine silky; cup-shaped.
½	.358	.10	39,800	59,200	46.0	69.0	.46*		Do.
¾	.505	.20	37,000	59,000	39.0	64.6	.39*	.39*	Do.
¾	.505	.20	40,500	60,500	37.5	59.8	.47*	.38	Do.

CONCRETE PILES.

COMPRESSION TESTS OF CONCRETE PILES.

Material Received from the Boston Elevated Railway Company.

Weight, 1,653 pounds = 149.2 pounds per cubic foot.

Sectional area, mean, 187.63 square inches.

Ends squared off and faced with neat cement.

Description furnished by Mr. Frederick F. Low, architect, Boston Elevated Railway Company.

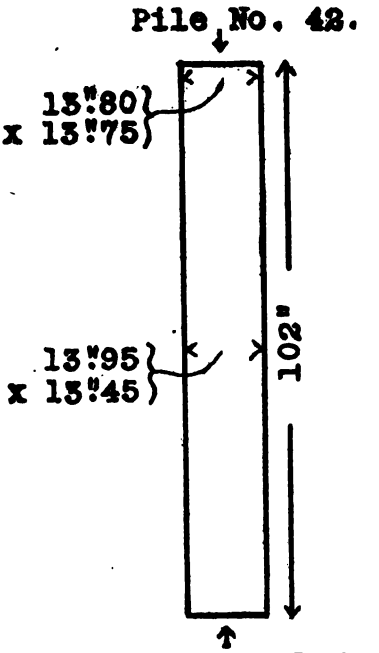
Composition: Portland cement, 1; sand, 2½; broken stone (granite), 4.

Reënforced with No. 3 electrically welded Clinton wire cloth.

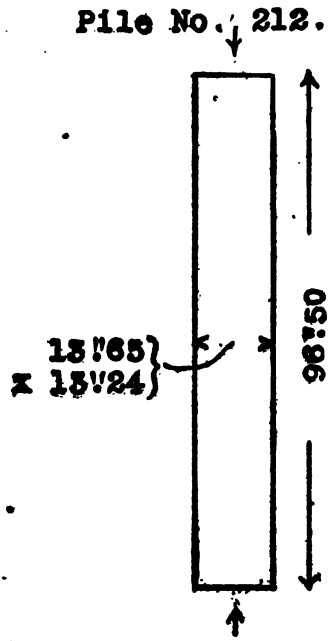
Cement used was lumpy.

This pile was cast January 4, 1907, in building heated by salamander stoves to an average temperature of 55°, where it was kept for a period of 18 days, when it was forwarded to the testing laboratory and thereafter kept at a temperature ranging from 60° to 70° F.

Age when tested, 2 months.



	Pounds.
First crack	482,000
Ultimate strength, total	482,000
Ultimate strength, per square inch	2,570



Opened oblique and longitudinal cracks near one end of the pile.

Weight, 1,561 pounds = 154.7 pounds per cubic foot.

Sectional area, 180.73 square inches.

Ends squared off and faced with neat cement.

Description furnished by Mr. Frederick F. Low, architect, Boston Elevated Railway Company.

Composition: Portland cement, 1; sand, 2½; broken stone (granite), 4.

Reënforced with No. 3 electrically welded Clinton wire cloth, consisting of 17 longitudinal wires, each ".25 diameter, and circular wires spaced 12" apart of ".15 diameter each, forming meshes 2" × 12". The wire cloth overlapped along one side of the pile.

This pile was cast out of doors December 3, 1906, in temperature of about 30° F.; covered with salt hay to a depth of 1 foot, over which canvas was spread. The following

day the temperature dropped to 2° F., and the fourth day afterwards to 2° F. below zero. The hay and canvas were removed December 28 and the pile left exposed to the weather until January 22, 1907, when it was forwarded to the testing laboratory.

Age when tested, 3 months 1 day.

	Pounds.
First crack	450,000
Ultimate strength, total	473,000
Ultimate strength, per square inch	2,620

Opened oblique and longitudinal cracks near one end of the pile.

BRICKS.

BRICKS.

COMPRESSION TESTS.

The following ten specimens represent bricks used in piers:

HARD, WATER-STRUCK BRICK FROM NEW ENGLAND BRICK COMPANY'S YARD NO. 34, ROCHESTER, N. H.

Dimensions.			Sectional area.	First crack.	Compressive strength.	
Height.	Compressed surface.				Total	Per square inch.
Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*
2.14	3.55	7.92	28.12	143,000	314,000	11,170
2.15	3.57	7.78	27.77	184,000	295,000	10,620
2.15	3.53	7.89	27.85	178,000	353,000	12,680
2.08	3.46	7.60	26.30	189,000	471,000	17,910
2.13	3.52	7.94	27.95	143,000	336,000	12,020

LIGHT HARD BRICK FROM NEW ENGLAND BRICK COMPANY'S YARD NO. 12, EPPING N. H.

2.20	3.78	7.93	29.98	53,000	200,800	6,700
2.34	3.75	7.86	29.48	88,000	238,200	8,080
2.26	3.81	7.92	30.18	128,000	183,000	6,060
2.39	3.95	8.18	32.31	74,000	119,000	3,680
2.33	3.90	8.09	31.55	122,000	146,000	4,620

ADDITIONAL SAMPLES RECEIVED FROM THE FREDONIA BRICK COMPANY, FREDONIA, KANS. RED CLAY FACE BRICKS.

COMPRESSION TESTS.

Description.	Dimensions.			Sectional area.	First crack.	Compressive strength.	
	Height.	Compressed surface.				Total.	Per square inch.
	Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*
Pressed I	2.23	3.87	8.02	31.04	204,000	227,000	7,310
Pressed II	2.30	3.91	8.12	31.75	184,000	219,000	6,900
Wire cut III	2.31	3.78	8.11	30.66	141,000	305,000	9,950
Wire cut IIII	2.80	3.70	8.75	32.38	59,000	224,000	6,920

ABSORPTION TESTS.

Bricks immersed in water one week.

Marks.	Weight.				Gain in weight.	Absorption.	
	Dry.		Wet.			By weight.	By volume.
	Lbs.	*Ozs.*	*Lbs.*	*Ozs.*	*Ounces.*	*Per cent.*	*Per cent.*
I	5	5	5	11½	6½	7.6	16.2
III	5	7½	5	13	5½	6.3	13.4

Paving Bricks.

COMPRESSION TESTS.

Specimens furnished by Messrs. Fiske & Co. (Incorporated), Boston, Mass.

Compressed surfaces faced with plaster of Paris.

Tested on edge.

Brand.	Color.	Weight.	Dimensions.			Sectional area.	First crack.	Compressive strength.	
			Height.	Compressed surface.				Total.	Per square inch.
		Lbs. Ozs.	*Inches.*	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds*
Vulcan.....	Dark buff ..	6 6½	4.08	2.43	8.57	20.83	85,000	192,000	9,217
James M. Pater.	Buff.....	8 12¾	3.91	3.18	9.13	29.03	71,000	292,000	10,059
Kushequa [a]....	Dark red ...	9 15½	3.97	3.20	9.23	29.54	112,000	348,000	11,781
None [a].....	.....do.....	9 13	3.90	3.30	9.00	29.70	126,000	388,500	12,963
Shawmut, Pa..	.....do.....	.....	3.87	3.10	8.97	27.81	52,000	276,000	9,924
Johnsonburg, Pa.	.....do.....	.....	3.91	3.14	9.40	29.52	42,000	372,000	12,602

[a] These two brick were made from the same clay. The brick branded "Kushequa" was re-pressed, the brick without brand mark being a wire-cut one.

The Shawmut and Johnsonburg bricks represent material which was used in piers Nos. 1759–1764.

These samples came from piers after testing, selecting bricks which showed no signs of injury during the pier tests.

Tests of material collected at the Louisiana Purchase Exposition at St. Louis, Mo., 1904.
Material contributed by The Parker-Russell Mining and Manufacturing Company, St. Louis, Mo.

Marks.	Description.	Color.	Dimensions.			Sectional area.	First crack.	Compressive strength.	
			Height.	Compressed surface.				Total.	Per square inch.
			Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*
No. 1	Fire bricks of a siliceous character	Buff	2.46	4.38	8.87	38.85	102,000	183,000	4,710
	do	do	2.51	4.38	8.86	38.81	106,000	175,800	4,530
	do	do	2.51	4.40	8.90	39.16	81,000	159,000	4,060
	do	do	2.48	4.38	8.84	38.72	110,000	165,600	4,280
	do	do	2.51	4.40	8.90	39.16	90,000	162,500	4,150
	do	do	2.46	4.39	8.87	38.94	90,000	179,200	4,600
XXX	Bricks of a little higher grade than No. 1, above, but of a siliceous nature	do	2.55	4.40	8.80	38.72	113,000	174,000	4,490
	do	do	2.53	4.43	8.93	39.56	114,000	166,500	4,210
	do	do	2.55	4.47	8.98	40.14	98,000	169,800	4,230
	do	do	2.52	4.42	8.92	39.43	123,000	178,200	4,520
	do	do	2.57	4.44	8.93	39.65	102,000	174,900	4,410
	do	do	2.55	4.40	8.82	38.81	113,000	157,000	4,050
☆☆☆	Bricks made from a Missouri clay which is very low in free silica	do	2.42	4.29	8.78	37.67	64,000	174,000	4,620
	do	do	2.40	4.21	8.63	36.33	88,000	201,000	5,530
	do	do	2.42	4.26	8.74	37.23	28,000	169,000	4,540
	do	do	2.41	4.23	8.67	36.67	57,000	210,000	5,730
	do	do	2.35	4.30	8.78	37.75	36,000	203,000	5,380
	do	do	2.40	4.21	8.61	36.25	43,000	182,000	5,020
SR-22	Tile for piers for support of retorts in gas bench settings. Marked "Atalanta."	Dark buff	6.45	7.35	8.96	65.86	90,000	129,600	1,970
	do	do	6.48	7.37	9.00	66.33	126,000	144,000	2,170
	do	do	6.46	7.32	9.00	65.88	75,000	113,000	1,720
	do	do	6.45	7.33	9.00	65.97	91.000	112,000	1,700
	Same, marked "Milwaukee"	do	6.43	7.21	8.66	62.44	102,000	178,000	2,850
	do	do	6.47	7.21	8.76	63.16	97,000	138,600	2,190

Hollow Partition Blocks.

Marks.	Description.	Dimensions of cores.	Color.	Dimensions.			Net sectional area.	First crack.	Compressive strength.	
				Height.	Compressed surface.				Total.	Per square inch.
		" "		*Inches.*	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*
	Semiporous, with two cores	2.20×2.85	Salmon	4.00	6.07	11.75	19.62	69,800	76,000	3,870
	.....do	2.28×2.97	.....do	4.12	6.26	12.00	20.40	59,600	59,600	2,920
	.....do	2.26×2.98	.....do	4.15	6.26	12.00	20.88	60,200	60,200	2,880
	.....do	2.25×2.95	.....do	4.10	6.22	11.96	20.57	62,000	62,000	3,010
	.....do	2.27×2.97	.....do	4.12	6.25	12.00	20.52	59,400	59,400	2,890
	.....do	2.22×2.96	.....do	4.12	6.15	11.96	20.45	71,000	71,000	3,470
	Porous, with three cores	2.66×3.06	.....do	4.13	12.13	11.68	48.47	.....	43,200	890
	.....do	2.67×3.06	.....do	4.14	12.10	11.65	47.65	.....	46,000	965
	.....do	2.70×3.08	.....do	4.16	12.18	11.86	48.39	.....	36,800	760
	.....do	2.69×3.07	.....do	4.14	12.14	11.78	47.94	.....	36,000	750
	.....do	2.70×3.10	.....do	4.17	12.23	11.78	48.65	.....	35,800	735
	.....do	2.67×3.08	.....do	4.15	12.22	11.86	49.93	.....	30,400	610
50_3	With two cores	2.23×2.98	Buff	4.15	6.20	6.01	10.46	39,800	39,800	3,800
50_4	.....do	2.23×2.99	.....do	4.13	6.20	5.90	10.27	44,100	44,100	4,290
50_5	.....do	2.24×2.99	.....do	4.13	6.21	6.05	10.47	41,700	41,700	3,980
50_1	.....do	2.22×2.98	.....do	4.12	6.21	11.90	21.06	82,200	82,200	3,900
50_2	.....do	2.23×2.98	.....do	4.12	6.21	11.93	20.88	92,400	92,400	4,430
	MATERIAL FROM P. BANNON & CO., LOUISVILLE, KY.									
13_1	With two cores	5.46×3.12	Buff	4.32	12.76	12.38	22.78	44,000	49,000	2,150
13_2	.....do	5.44×3.08	.....do	4.28	12.69	12.22	22.12	52,000	46,000	2,080

CEMENT-SAND BRICKS.

Specimens received from Mr. Albert J. Capron, Portland, Oreg.
Made by Cement Products Company, Portland, Oreg.
Each brick was made with a panel 2″.05×6″.17 by ″.32 deep.

COMPRESSION TESTS.

Panels were filled with neat cement and compressed surfaces were then faced with plaster of Paris.

Marks.	Color.	Dimensions.			Sectional area.	First crack.	Compressive strength.	
		Height.	Compressed surfaces.				Total.	Per square inch.
		Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*
A1	Gray.....	2.25	3.98	8.12	32.32	81,100	85,800	2,650
B1	Red.....	2.26	3.98	8.13	32.36	98,000	109,100	3,370

ABSORPTION OF WATER.

Marks.	Weight.				Gain in weight.	Absorption.	
	Dry.		Wet.			By weight.	By volume.
	Lbs.	*Ozs.*	*Lbs.*	*Ozs.*	*Ounces.*	*Per cent.*	*Per cent.*
A1	4	10½	5	3½	9½	12.4	23.3
B1	4	12½	5	5	8½	11.1	21.3

BRICKS.

COMPRESSION TESTS.

Material contributed by Mr. Albert J. Capron, Portland, Oreg.

Description.	Dimensions.			Sectional area.	First crack.	Compressive strength.	
	Height.	Compressed surface.				Total.	Per square inch.
	Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*
a Red face brick	2.32	3.89	8.15	31.70	126,000	434,000	13,690
Do	2.34	3.91	8.20	32.06	125,000	514,000	16,030
b Red paving brick	4.16	2.58	8.70	22.45	216,000	424,000	18,890
Do	4.02	2.58	8.73	22.52	149,000	419,000	18,610

The paving brick were branded "Western Clay Mfg. Co." They were tested on edge.

ABSORPTION TESTS ON SAMPLES A AND B.

Time of immersion, 7 days.

Marks.	Weight.				Gain in weight.	Absorption.	
	Dry.		Wet.			By weight.	By volume.
	Lbs.	*Ozs.*	*Lbs.*	*Ozs.*	*Ounces.*	*Per cent.*	*Per cent.*
a	6	0	6	3	3	3.1	7.1
b	7	8	7	11	3	2.5	5.6

SAND-LIME BRICKS FROM THE QUARTERMASTER, U. S. ARMY, WEST POINT, N. Y.

COMPRESSION TESTS.

Samples labeled "Rochester Composite Brick Co., Rochester, N. Y."

Compressed surfaces faced with plaster of Paris.

Marks.	Description.	Dimensions.			Sectional area.	First crack.	Ultimate strength.	
		Height.	Compressed surface.				Total.	Per square inch.
		Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*
60	Whole brick	2.35	4.01	8.17	32.76	97,000	127,000	3,880
72	Half brick	2.37	4.02	4.10	16.48	87,000	89,800	5,450
73	.....do	2.45	4.04	4.20	16.97	76,200	77,800	4,580

SAND-LIME BRICKS RECEIVED FROM SANDY HOOK PROVING GROUND.

TRANSVERSE TESTS.

Ends supported 7 inches apart, loaded at the middle.

Description.	Dimensions.		Ultimate strength.	
	Width.	Depth.	Total.	Mod. of R per square inch.
	Inches.	*Inches.*	*Pounds.*	*Pounds.*
The Sand-lime Brick Company, No. 1	3.98	2.28	529	264
The Sand-lime Brick Company, No. 2	4.00	2.25	660	342
Granite Brick Company [a]	4.08	2.29	610	300
The Diamond Stone Brick Company	4.00	2.20	1,220	662
The Peerless Brick Company [b]				

[a] Diamond-shaped, sunken panel used on the compression side of the sample.
[b] Broken when received. No transverse test feasible.

ABSORPTION OF WATER.

One-half of each of the above bricks was immersed in water 48 hours.

Description.	Weight.				Gain in weight.	Absorption.	
	Dry.		Wet.			By weight.	By volume.
	Lbs.	*Ozs.*	*Lbs.*	*Ozs.*	*Ounces.*	*Per cent.*	*Per cent.*
The Sand-lime Brick Co., No. 1	2	5½	2	10¾	5¼	14.0	24.7
The Sand-lime Brick Co., No. 2	2	5	2	10	5	13.5	24.0
Granite Brick Co	2	6¾	2	12¾	6	15.5	27.4
The Diamond Stone Brick Co	2	4	2	8¼	4¼	11.8	20.6
The Peerless Brick Co	2	4½	2	10	5½	15.1	24.7

COMPRESSION TESTS.

Half bricks after having been immersed in water 48 hours. Compressed surfaces faced with plaster of Paris.

Description.	Dimensions.			Sectional area.	First crack.	Compressive strength.	
	Height.	Compressed surface.				Total	Per square inch.
	Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*
The Sand-lime Brick Co., No. 1	2.28	3.98	4.05	16.12	39,300	45,100	2,800
The Sand-lime Brick Co., No. 2	2.25	4.00	4.00	16.00	29,200	36,600	2,290
Granite Brick Co	2.29	4.08	4.06	16.56	31,600	35,300	2,130
The Diamond Stone Brick Co	2.20	4.00	4.05	16.20	50,000	53,100	3,280
The Peerless Brick Co	2.38	4.05	4.00	16.20	20,000	25,200	1,560

Other half of bricks, which had not been immersed in water. Compressed surfaces faced with plaster of Paris.

COMPRESSION TESTS—Continued.

Description.	Dimensions.			Sectional area.	First crack.	Compressive strength.	
	Height.	Compressed surface.				Total.	Per square inch.
	Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*
The Sand-lime Brick Co., No. 1	2.28	3.98	3.76	14.96	45,500	50,500	3,380
The Sand-lime Brick Co., No. 2	2.25	4.00	3.57	14.28	23,000	27,900	1,950
Granite Brick Co	2.29	4.08	2.82	11.51	20,900	23,400	2,030
The Diamond Stone Brick Co	2.20	4.00	3.80	15.20	45,400	46,700	3,070

Compressive Elastic Properties of Brick.

No. 1234.

From the Hydraulic Press Brick Company, Washington Branch, Washington, D. C.

Dark red face brick. Color, No. 8.

Dimensions, 2″.36×4″.02 by 8″.28 long.

Sectional area, 9.49 square inches.

Gauged length, 5″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
1,898	200	0.	0.	Initial load.
4,745	500	.0017	0.	
9,490	1,000	.0044	.0005	
14,235	1,500	.0070	.0007	
18,980	2,000	.0088	.0010	
23,725	2,500	.0123	.0013	
28,470	3,000	.0150	.0017	E (1,000–3,000)=1,081,000 pounds per square inch.
33,215	3,500	.0178	.0022	
37,960	4,000	.0229	.0029	
40,500	4,268	.....	.....	Ultimate strength.

No. 1235.

From the Hydraulic Press Brick Company, Washington Branch, Washington, D. C.
Color, No. 58; light chocolate, mottled.
Weight, 5 pounds 7½ ounces = 126 pounds per cubic foot.
Dimensions, 2″.30 × 3″.98 by 8″.19 long.
Sectional area, 9.15 square inches.
Gauged length, 5″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
1,830	200	0.	0.	Initial load.
4,575	500	.0008	0.	
9,150	1,000	.0023	0.	
13,725	1,500	.0037	0.	
18,300	2,000	.0052	0.	
22,875	2,500	.0067	.0001	
27,450	3,000	.0081	.0002	E (1,000–3,000) = 1,786,000 pounds per square inch.
32,025	3,500	.0095	.0004	
36,600	4,000	.0109	.0006	
78,100	8,536	.....	.....	Ultimate strength.

No. 1236.

From the Hydraulic Press Brick Company, Washington Branch, Washington, D. C.
Color, No. 79; light buff, mottled.
Weight, 5 pounds 10 ounces = 129.8 pounds per cubic foot.
Dimensions, 2″.29 × 4″.05 by 8″.07 long.
Sectional area, 9.27 square inches.
Gauged length, 5″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
1,854	200	0.	0.	Initial load.
4,635	500	.0005	0.	
9,270	1,000	.0011	0.	
13,905	1,500	.0020	0.	
18,540	2,000	.0030	0.	
23,175	2,500	.0039	0.	
27,810	3,000	.0049	0.	E (1,000–3,000) = 2,778,000 pounds per square inch.
32,445	3,500	.0059	.0001	
37,080	4,000	.0069	.0001	
41,715	4,500	.0080	.0002	
46,350	5,000	.0090	.0002	E (1,000–5,000) = 2,598,000 pounds per square inch.
125,200	13,506	.....	.....	Ultimate strength.

No. 1237.

From the Hydraulic Press Brick Company, Washington Branch, Washington, D. C.

Color, No. 149; light chocolate, fine mottled.

Weight, 5 pounds 8½ ounces = 130.5 pounds per cubic foot.

Dimensions, 2″.30 × 3″.92 by 8″.12 long.

Sectional area, 9.02 square inches.

Gauged length, 5″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
1,804	200	0.	0.	Initial load.
4,510	500	.0005	0.	
9,020	1,000	.0016	0.	
13,530	1,500	.0026	0.	
18,040	2,000	.0037	0.	
22,550	2,500	.0048	.0001	
27,060	3,000	.0059	.0002	E (1,000-3,000) = 2,439,000 pounds per square inch.
31,570	3,500	.0072	.0003	
36,080	4,000	.0083	.0003	
40,590	4,500	.0092	.0004	
45,100	5,000	.0103	.0004	E (1,000-5,000) = 2,410,000 pounds per square inch.
121,500	13,470	.....	.....	Ultimate strength.

No. 1238.

From The Coffeyville Vitrified Brick and Tile Company, Coffeyville, Kans.

Dry pressed face brick. Grade 1, shade 5. Color, medium red.

Weight, 5 pounds 14 ounces = 119.4 pounds per cubic foot.

Dimensions, 2″.46 × 4″.15 by 8″.33 long.

Sectional area, 10.21 square inches.

Gauged length, 5″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,042	200	0.	0.	Initial load.
5,105	500	.0015	.0003	
10,210	1,000	.0041	.0005	
15,315	1,500	.0070	.0008	
20,420	2,000	.0111	.0015	E (1,000-2,000) = 833,300 pounds per square inch.
23,000	2,253	.....	.....	Ultimate strength.

No. 1239.

From The Coffeyville Vitrified Brick and Tile Company, Coffeyville, Kans.
Color, red. Grade 1, shade 10.
Weight, 5 pounds 15½ ounces = 118.9 pounds per cubic foot.
Dimensions, 2″.47 × 4″.18 by 8″.40 long.
Sectional area, 10.32 square inches.
Gauged length, 5″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,064	200	0.	0.	Initial load.
5,160	500	.0004	0.	
10,320	1,000	.0012	0.	
15,480	1,500	.0020	0.	
20,640	2,000	.0029	0.	
25,800	2,500	.0040	−.0001	
30,960	3,000	.0050	0.	E (1,000–3,000) = 2,632,000 pounds per square inch.
36,120	3,500	.0062	−.0001	
41,280	4,000	.0075	0.	
46,440	4,500	.0090	0.	
51,600	5,000	.0105	0.	E (1,000–5,000) = 2,151,000 pounds per square inch.
62,400	6,046	.....	.....	Ultimate strength.

No. 1240.

From The Coffeyville Vitrified Brick and Tile Company, Coffeyville, Kans.
Paving brick. Color, dark red.
Weight, 6 pounds 4½ ounces = 124.8 pounds per cubic foot.
Dimensions, 2″.42 × 4″.23 by 8″.49 long.
Sectional area, 10.24 square inches.
Gauged length, 5″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,048	200	0.	0.	Initial load.
5,120	500	.0002	0.	
10,240	1,000	.0007	0.	
15,360	1,500	.0013	0.	
20,480	2,000	.0017	0.	
25,600	2,500	.0022	0.	
30,720	3,000	.0026	0.	E (1,000–3,000) = 5,263,000 pounds per square inch.
35,840	3,500	.0032	0.	
40,960	4,000	.0039	0.	
46,080	4,500	.0043	0.	
51,200	5,000	.0049	0.	E (1,000–5,000) = 4,762,000 pounds per square inch.
89,000	8,691	.....	.....	First crack.
90,400	8,828	.....	.....	Ultimate strength.

No. 1241.

From The Coffeyville Vitrified Brick and Tile Company, Coffeyville, Kans.
Color, dark red.
Weight, 8 pounds 1½ ounces = 146.4 pounds per cubic foot.
Dimensions, 2″.99 × 3″.89 by 8″.22 long.
Sectional area, 11.63 square inches.
Gauged length, 5″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,326	200	0.	0.	Initial load.
5,815	500	0.	0.	
11,630	1,000	.0002	0.	
17,445	1,500	.0006	0.	
23,260	2,000	.0010	0.	
29,075	2,500	.0013	0.	
34,890	3,000	.0017	0.	E (1,000-3,000) = 6,667,000 pounds per square inch.
40,705	3,500	.0020	0.	
46,520	4,000	.0025	0.	
52,335	4,500	.0027	0.	
58,150	5,000	.0031	0.	
63,965	5,500	.0035	0.	
69,780	6,000	.0040	0.	E (1,000-6,000) = 6,579,000 pounds per square inch.
201,000	17,283	.....	.....	First crack.
218,000	18,745	.....	.....	Ultimate strength.

No. 1242.

From Canton Pressed Brick Company, Canton, Ohio.
Cream colored.
Weight, 6 pounds 4 ounces = 132.7 pounds per cubic foot.
Dimensions, 2″.39 × 4″.04 by 8″.42 long.
Sectional area, 9.66 square inches.
Gauged length, 5″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
1,932	200	0.	0.	Initial load.
4,830	500	.0008	0.	
9,660	1,000	.0022	.0001	
14,490	1,500	.0037	.0002	
19,320	2,000	.0051	.0003	
24,150	2,500	.0066	.0005	
28,980	3,000	.0081	.0006	E (1,000-3,000) = 1,852,000 pounds per square inch.
33,810	3,500	.0095	.0007	
38,640	4,000	.0109	.0008	
43,470	4,500	.0122	.0010	
48,300	5,000	.0138	.0011	E (1,000-5,000) = 1,887,000 pounds per square inch.
75,500	7,816	.....	.....	Ultimate strength.

No. 1243.

From Canton Pressed Brick Company, Canton, Ohio.
Color, red.
Weight, 5 pounds 11 ounces = 136.8 pounds per cubic foot.
Dimensions, 2″.30 × 3″.84 by 8″.13 long.
Sectional area, 8.83 square inches.
Gauged length, 5″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
1,766	200	0.	0.	Initial load.
4,415	500	0.	0.	
8,830	1,000	.0001	0.	
13,245	1,500	.0002	0.	
17,660	2,000	.0009	0.	
22,075	2,500	.0016	.0001	
26,490	3,000	.0021	0.	
30,905	3,500	.0029	0.	E (1,500-3,500)=3,704,000 pounds per square inch.
35,320	4,000	.0035	.0001	
.....	500	.0001	.....	
.....	1,000	.0001	.....	
.....	2,000	.0010	.....	
.....	2,500	.0015	.....	
.....	3,000	.0022	.....	
.....	3,500	.0030	.....	
.....	4,000	.0036	.....	
39,735	4,500	.0042	.0001	
44,150	5,000	.0050	.0002	
48,565	5,500	.0057	.0003	
52,980	6,000	.0065	.0004	E (1,500-6,000)=3,814,000 pounds per square inch.
99,900	11,314	.....	.....	Ultimate strength.

No. 1244.

From Tuna Valley Pressed Brick Company, Bradford, Pa.
Face brick. Color, red.
Made from shale; burnt with natural gas.
Weight, 5 pounds 14 ounces = 135 pounds per cubic foot.
Dimensions, 2″.37 × 3″.93 by 8″.07 long.
Sectional area, 9.31 square inches.
Gauged length, 5″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
1,862	200	0.	0.	Initial load.
4,655	500	.0012	.0005	
9,310	1,000	.0020	.0007	
13,965	1,500	.0030	.0008	
18,620	2,000	.0042	.0009	
23,275	2,500	.0054	.0011	
27,930	3,000	.0068	.0014	E (1,000-3,000)=2,494,000 pounds per square inch..
32,585	3,500	.0084	.0022	
37,240	4,000	.0098	.0027	
41,895	4,500	.0112	.0032	
46,550	5,000	.0130	.0039	E (1,000-5,000)=2,564,000 pounds per square inch.
72,800	7,820	.....	.....	Ultimate strength.

No. 1245.

From Tuna Valley Pressed Brick Company, Bradford, Pa.
Face brick. Color, red. Marks, B6.
Weight, 6 pounds = 142.2 pounds per cubic foot.
Dimensions, 2″.37 × 3″.94 by 7″.81 long.
Sectional area, 9.34 square inches.
Gauged length, 5″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
1,868	200	0.	0.	Initial load.
4,670	500	0.	0.	
9,340	1,000	.0001	0.	
14,010	1,500	.0005	0.	
18,680	2,000	.0010	0.	
23,350	2,500	.0014	0.	
28,020	3,000	.0018	0.	
32,690	3,500	.0023	0.	E (1,500–3,500) = 5,556,000 pounds per square inch.
37,360	4,000	.0030	0.	
42,030	4,500	.0035	.0001	
46,700	5,000	.0041	.0001	
51,370	5,500	.0046	.0002	
56,040	6,000	.0051	.0002	E (1,500–6,000) = 5,114,000 pounds per square inch.
132,500	14,186	.....	.....	Ultimate strength.

No. 1246.

From Jewettville Pressed and Paving Brick Company, Buffalo, N. Y.
Wire-cut face bricks. Color, red. Marks, No. 9.
Weight, 6 pounds ½ ounce = 140.3 pounds per cubic foot.
Dimensions, 2″.31 × 3″.96 by 8″.12 long.
Sectional area, 9.15 square inches.
Gauged length, 5″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
1,830	200	0.	0.	Initial load.
4,575	500	.0001	0.	
9,150	1,000	.0004	0.	
13,725	1,500	.0008	0.	
18,300	2,000	.0011	0.	
22,875	2,500	.0015	0.	
27,450	3,000	.0020	0.	E (1,000–3,000) = 6,250,000 pounds per square inch.
32,025	3,500	.0023	0.	
36,600	4,000	.0027	.0001	
41,175	4,500	.0032	.0001	
45,750	5,000	.0037	.0002	
50,325	5,500	.0041	.0002	
54,900	6,000	.0045	.0002	
59,475	6,500	.0049	.0002	
64,050	7,000	.0053	.0002	E (1,000–7,000) = 6,383,000 pounds per square inch.
217,400	23,760	.....	.....	Ultimate strength.

No. 1247.

From Jewettville Pressed and Paving Brick Company, Buffalo, N. Y.
Wire-cut face bricks. Color, red. Marks, No. 10.
Weight, 6 pounds ½ ounce = 141.4 pounds per cubic foot.
Dimensions, 2″.30 × 3″.95 by 8″.12 long.
Sectional area, 9.09 square inches.
Gauged length, 5″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
1,818	200	0.	0.	Initial load.
4,545	500	.0001	0.	
9,090	1,000	.0001	0.	
13,635	1,500	.0005	0.	
18,180	2,000	.0008	0.	
22,725	2,500	.0011	0.	
27,270	3,000	.0014	0.	E (1,000–3,000) = 7,692,000 pounds per square inch.
31,815	3,500	.0017	0.	
36,360	4,000	.0021	0.	
40,905	4,500	.0024	0.	
45,450	5,000	.0028	0.	
49,995	5,500	.0033	0.	
54,540	6,000	.0036	0.	
59,085	6,500	.0040	0.	
63,630	7,000	.0044	.0001	E (1,000–7,000) = 7,143,000 pounds per square inch.
230,000	25,302	.....	.....	Ultimate strength.

No. 1248.

From the Texarkana Brick Company, Texarkana, Ark.
Face brick. Color, red. Marks, 1.
Weight, 5 pounds 10 ounces = 134.6 pounds per cubic foot.
Dimensions, 2″.28 × 3″.91 by 8″.10 long.
Sectional area, 8.91 square inches.
Gauged length, 5″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
1,782	200	0.	0.	Initial load.
4,455	500	0.	0.	
8,910	1,000	.0005	0.	
13,365	1,500	.0012	0.	
17,820	2,000	.0019	0.	
22,275	2,500	.0026	0.	
26,730	3,000	.0034	0.	E (1,000–3,000) = 3,448,000 pounds per square inch.
31,185	3,500	.0041	0.	
35,640	4,000	.0050	0.	
40,095	4,500	.0058	.0001	
44,550	5,000	.0068	.0001	
49,005	5,500	.0079	.0001	
53,460	6,000	.0087	.0002	E (1,000–6,000) = 3,125,000 pounds per square inch.
79,200	8,889	.....	.....	Ultimate strength.

No. 1249.

From the Texarkana Brick Company, Texarkana, Ark.
Color, light red. Marks, II.
Weight, 5 pounds 9 ounces = 129.6 pounds per cubic foot.
Dimensions, 2″.29 × 3″.99 by 8″.12 long.
Sectional area, 9.14 square inches.
Gauged length, 5″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
1,828	200	0.	0.	Initial load.
4,570	500	.0002	0.	
9,140	1,000	.0012	0.	
13,710	1,500	.0024	0.	
18,280	2,000	.0041	0.	
22,850	2,500	.0057	0.	
27,420	3,000	.0078	.0002	E (1,000–3,000) = 1,563,000 pounds per square inch.
31,990	3,500	.0099	.0002	
36,560	4,000	.0124	.0006	
47,200	5,164	.....	.....	Ultimate strength.

No. 1250.

From the Texarkana Brick Company, Texarkana, Ark.
Color, light. Marks, III.
Weight, 5 pounds 7½ ounces = 115.9 pounds per cubic foot.
Dimensions, 2″.32 × 4″.19 by 8″.38 long.
Sectional area, 9.72 square inches.
Gauged length, 5″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
1,944	200	0.	0.	Initial load.
4,860	500	.0049	.0014	
9,720	1,000	.0164	.0056	
17,050	1,754	.....	.....	Ultimate strength.

No. 1251.

From the T. B. Townsend Brick and Contracting Company, Zanesville, Ohio.

No. 1 paving block. Center brick from Endaly kiln. Color, dark brown.

Branded: "Townsend Block Z."

Weight, 8 pounds 10 ounces = 139.3 pounds per cubic foot.

Dimensions, 3″.20 × 3″.90 by 8″.57 long.

Sectional area, 12.48 square inches.

Gauged length, 5″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,496	200	0.	0.	Initial load.
6,240	500	0.	0.	
12,480	1,000	.0005	0.	
18,720	1,500	.0009	0.	
24,960	2,000	.0012	0.	
31,200	2,500	.0014	0.	
37,440	3,000	.0018	0.	E (1,000-3,000) = 7,692,000 pounds per square inch.
43,680	500	.0022	−.0001	
49,920	4,000	.0026	0.	
56,160	4,500	.0031	0.	
62,400	5,000	.0035	0.	
68,640	5,500	.0040	0.	
74,880	6,000	.0043	0.	
81,120	6,500	.0047	0.	
87,360	7,000	.0052	0.	E (1,000-7,000) = 6,383,000 pounds per square inch.
160,000	12,821	.....	.....	First crack.
192,000	15,385	.....	.....	Ultimate strength.

Tests of Material Collected at the Louisiana Purchase Exposition, St. Louis, Mo., 1904.

COMPRESSIVE ELASTIC PROPERTIES OF BRICK.

No. 1225.

Marks, 51,.
From the St. Louis Vitrified and Fire Brick Company, St. Louis, Mo.
Dark red brick.
Dimensions, 2″.45 × 3″.99 by 8″.37 long.
Sectional area, 9.78 square inches.
Gauged length, 5″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
1,956	200	0.	0.	Initial load.
4,890	500	0.	0.	
9,780	1,000	.0002	.....	
14,670	1,500	.0006	.....	
19,560	2,000	.0010	0.	
24,450	2,500	.0012	.....	
29,340	3,000	.0014	0.	E (1,000–3,000) = 8,333,000 pounds per square inch.
34,230	3,500	.0017	.....	
39,120	4,000	.0020	−.0001	
44,010	4,500	.0022	.....	
48,900	5,000	.0025	.....	Snapping sound.
53,790	5,500	.0029	.....	
58,680	6,000	.0032	−.0002	
63,570	6,500	.0034	.....	
68,460	7,000	.0037	.....	
73,350	7,500	.0040	.....	
78,240	8,000	.0042	−.0002	
83,130	8,500	.0045	.....	
88,020	9,000	.0047	.....	
92,910	9,500	.0051	.....	
97,800	10,000	.0055	−.0002	E (1,000–10,000) = 8,182,000 pounds per square inch.
.....	2,000	.0009	.....	
.....	4,000	.0020	.....	
.....	6,000	.0031	.....	
.....	8,000	.0042	.....	
.....	6,000	.0032	.....	
.....	4,000	.0019	.....	
.....	2,000	.0008	−.0002	
376,000	38,446	.....	.....	Ultimate strength.

Brick broke up into a large number of fragments under the maximum load.

No. 1226.

Marks, 51_{15}.
From the St. Louis Vitrified and Fire Brick Company, St. Louis, Mo.
Branded: "St. Louis V. & F. B. Co."
Dimensions, 2″.89×3″.96 by 8″.95 long.
Sectional area, 11.44 square inches.
Gauged length, 5″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,288	200	0.	0.	Initial load.
5,720	500	.0005	.....	
11,440	1,000	.0010	0.	
17,160	1,500	.0014	.....	
22,880	2,000	.0019	—.0001	
28,600	2,500	.0024	.....	
34,320	3,000	.0029	—.0001	E (1,000-3,000)=5,000,000 pounds per square inch.
40,040	3,500	.0034	.....	
45,760	4,000	.0038	0.	
51,480	4,500	.0042	.....	
57,200	5,000	.0046	0.	
62,920	5,500	.0050	.....	
68,640	6,000	.0055	0.	
74,360	6,500	.0059	.....	
80,080	7,000	.0064	.0001	
.....	2,000	.0021	.....	
.....	4,000	.0040	.....	
.....	6,000	.0056	.....	
.....	4,000	.0040	.....	
.....	2,000	.0021	.0001	
85,800	7,500	.0068	.....	
91,520	8,000	.0072	.0001	E (1,000-8,000)=5,738,000 pounds per square inch.
146,000	12,762	.....	.....	First crack.
239,200	20,892	.....	.....	Ultimate strength.

Pyramidal fragments.

No. 1227.

Marks, 52_5.
From Missouri.
Dark chocolate color. Branded: "Athens Block."
Dimensions, 3".47 × 4".02 by 9".06 long.
Sectional area, 13.95 square inches.
Gauged length, 5".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,790	200	0.	0.	Initial load.
6,975	500	.0004	.....	
13,950	1,000	.0012	0.	
20,925	1,500	.0016	.....	
27,900	2,000	.0020	0.	
34,875	2,500	.0025	.....	
41,850	3,000	.0031	0.	E (1,000-3,000)=5,263,000 pounds per square inch.
48,825	3,500	.0036	.....	
55,800	4,000	.0042	0.	
62,775	4,500	.0047	.....	
69,750	5,000	.0052	.0002	
76,725	5,500	.0057	.....	First crack.
83,700	6,000	.0064	.0002	
90,675	6,500	.0076	.....	
97,650	7,000	.0081	.0008	
104,625	7,500	.0086	.....	
111,600	8,000	.0092	.0009	
118,575	8,500	.0098	.....	
125,550	9,000	.0109	.0013	E (1,000-9,000)=4,762,000 pounds per square inch.
166,400	11,928	.....	.....	Ultimate strength.

Pyramidal fragments.

No. 1228.

Marks, 53_4.
From Missouri.
Brown paver branded, "Malvern Blue Granite."
Dimensions, 3″.53 × 4″.80 by 8″.56 long.
Sectional area, 16.94 square inches.
Gauged length, 5″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
3,388	200	0.	0.	Initial load.
8,470	500	.0003	.....	
16,940	1,000	.0006	0.	
25,410	1,500	.0009	.....	
33,880	2,000	.0013	0.	
42,350	2,500	.0017	.....	
50,820	3,000	.0023	.0001	E (1,000-3,000) = 6,250,000 pounds per square inch.
59,290	3,500	.0028	.....	First crack.
67,760	4,000	.0034	.0002	
76,230	4,500	.0040	.....	
84,700	5,000	.0044	.0003	
93,170	5,500	.0050	.....	
101,640	6,000	.0056	.0003	
110,110	6,500	.0064	.....	
118,580	7,000	.0074	.0007	E (1,000-7,000) = 4,918,000 pounds per square inch.
127,000	7,497	.....	.....	Ultimate strength.

Pyramidal fracture.

No. 1229.

Marks, 58_9.
From New Mexico.
Dark brown vitrified sidewalk brick.
Dimensions, 1″.75×4″.60 by 9″.20 long.
Sectional area, 8.05 square inches.
Gauged length, 5″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
1,610	200	0.	0.	Initial load.
4,025	500	.0002	.....	
8,050	1,000	.0010	0.	
12,075	1,500	.0015	.....	
16,100	2,000	.0021	0.	
20,125	2,500	.0028	.....	Snapping sounds.
24,150	3,000	.0036	.0001	E (1,000–3,000)=4,000,000 pounds per square inch.
28,175	3,500	.0044	.....	
32,200	4,000	.0051	.0001	
36,225	4,500	.0057	.....	
40,250	5,000	.0064	.0003	E (1,000–5,000)=3,922,000 pounds per square inch.
51,800	6,435	.....	.....	Ultimate strength.

Failed with longitudinal, oblique lines of rupture.

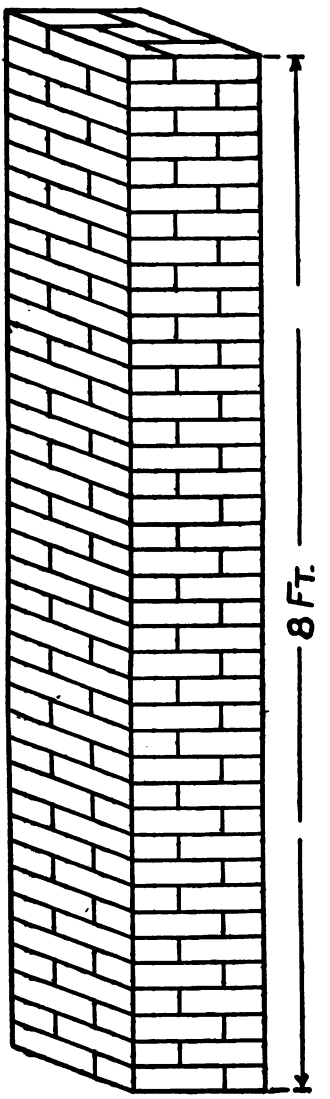
No. 1230.

Marks, 59.
From Laclede Fire Brick Manufacturing Company, St. Louis, Mo.
Buff colored tile. Branded "Laclede—St. Louis."
Total weight, 39.25 pounds=119.7 pounds per cubic foot.
Dimensions, 2″.44×9″.81 by 23″.68 long.
Sectional area, 23.94 square inches.
Gauged length, 10″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,394	100	0.	0.	Initial load.
11,970	500	.0020	0.	
23,940	1,000	.0045	0.	
35,910	1,500	.0070	.0002	
47,880	2,000	.0098	.0004	
59,850	2,500	.0124	.0007	
71,820	3,000	.0153	.0010	E (1,000–3,000)=2,041,000 pounds per square inch.
83,790	3,500	.0185	.0013	
95,760	4,000	.0218	.0015	
107,730	4,500	.0250	.0018	
119,700	5,000	.0289	.0022	E (1,000–5,000)=1,802,000 pounds per square inch.
132,200	5,522	.....	.....	Ultimate strength.

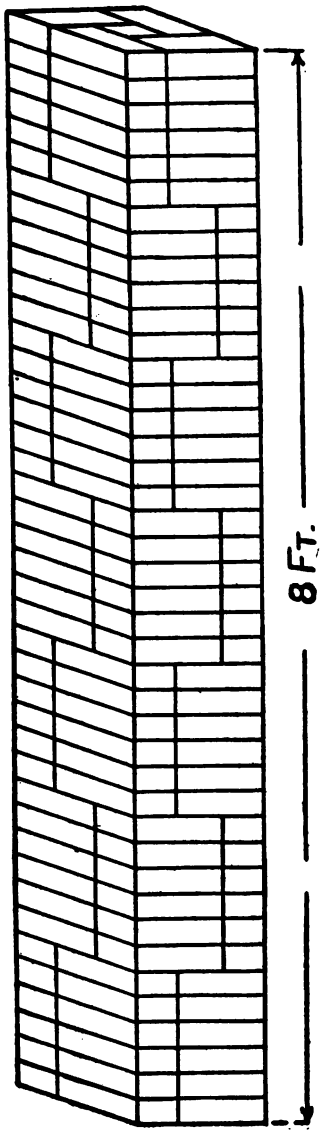
Failed with longitudinal, oblique lines of rupture.

BRICK PIERS.



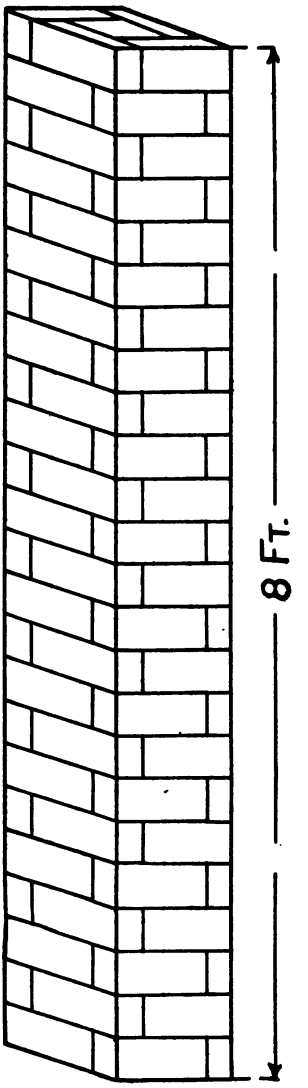
BRICK PIER.

Bricks laid flat; joints broken every course.



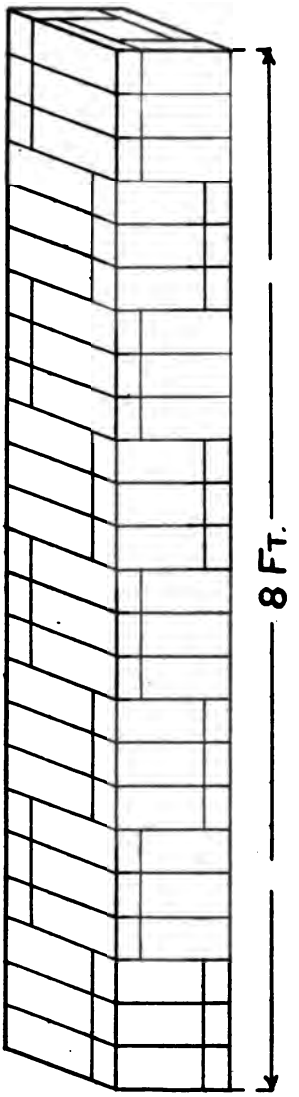
BRICK PIER.

Bricks laid flat; joints broken every six course.



BRICK PIER.

Bricks laid on edge; joints broken every course.



BRICK PIER.

Bricks laid on edge; joints broken every three courses.

No. 1815.

12″ RE-PRESSED BRICK PIER.

Re-pressed brick; red color.
Built of 39 courses of brick, with hollow core.
Laid in cement mortar—1 part Alpha cement and 3 parts sand.
Age, 2 years.
Weight, 907 pounds = 128.7 pounds per cubic foot.
Height of pier, 96.70 inches.
Outside dimensions, 12″.08 × 12″.10 = 146.17 square inches.
Core, 4″.50 × 4″.50 = 20.25 square inches.
Net sectional area, 125.92 square inches.
Average thickness of joints, ″.30.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
12,592	100	0.	0.	Initial load. Loaded with 10,000 pounds before testing.
18,888	150	.0020	.0004	
25,184	200	.0034	.0005	
31,480	250	.0055	.0006	
37,776	300	.0073	.0006	
44,072	350	.0094	.0008	
50,368	400	.0112	.0009	
56,664	450	.0130	.0012	
62,960	500	.0150	.0015	
69,256	550	.0171	.0014	
75,552	600	.0191	.0019	E (100–600) = 1,458,000 pounds per square inch.
.....	600	.0193	.0019	
81,848	650	.0211	.....	
88,144	700	.0233	.....	
94,440	750	.0252	.....	
100,736	800	.0271	.....	
107,032	850	.0293	.....	Snapping sounds.
113,328	900	.0313	.....	
119,624	950	.0332	.....	
125,920	1,000	.0353	.0033	E (600–1,000) = 1,352,000 pounds per square inch.
.....	600	.0215	.0032	
.....	600	.0216	.0031	
132,216	1,050	.0379	.....	
138,512	1,100	.0400	.....	
144,808	1,150	.0427	.....	
151,104	1,200	.0447	.....	
157,400	1,250	.0469	.....	
163,696	1,300	.0492	.....	
169,992	1,350	.0513	.....	
176,288	1,400	.0536	.....	
182,584	1,450	.0556	.....	
188,880	1,500	.0581	.0055	E (1,000–1,500) = 1,214,000 pounds per square inch.
.....	600	.0254	.0055	
.....	600	.0254	.0055	
201,472	1,600	.0668	.....	
214,064	1,700	.0682	.0068	
.....	600	.0272	.0065	
.....	600	.0271	.0065	
274,000	2,176	.....	.....	Ultimate strength.

Bricks crushed in the second, sixth, and seventh courses from the top. Opened longitudinal cracks in upper half of pier.

No. 1826.

12" FACE BRICK PIER.

Red, wire-cut face brick.
Material received from the Saco Brick Company, Saco, Me.
Built of 39 courses of brick, with solid core.
Laid in cement mortar—1 part Saylor's Portland cement and 1 part sand.
Age, 3 months 6 days.
Weight, 964 pounds = 132.6 pounds per cubic foot.
Height of pier, 95.70 inches.
Sectional area, 11".41 × 11".50 = 131.22 square inches.
Average thickness of joints, ".30.
Gauged length, 50".
The bed joints of this pier were not well filled with mortar.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
13,122	100	0.	0.	Initial load. Loaded with 8,000 pounds before testing.
19,683	150	.0009	0.	
26,244	200	.0015	0.	
32,805	250	.0022	.0001	
39,366	300	.0033	.0001	
45,927	350	.0040	.0004	
52,488	400	.0047	.0004	
59,049	450	.0055	.0004	
65,610	500	.0064	.0005	
72,171	550	.0070	.0006	
78,732	600	.0079	.0007	E (100-600) = 3,472,000 pounds per square inch.
.....	600	.0078	.0006	
85,293	650	.0088	.....	
91,854	700	.0093	.....	
98,415	750	.0100	.....	
104,976	800	.0110	.....	
111,537	850	.0117	.....	
118,098	900	.0126	.....	
124,659	950	.0135	.....	Snapping sounds.
131,220	1,000	.0146	.0011	E (600-1,000) = 3,175,000 pounds per square inch.
.....	600	.0088	.0011	
.....	600	.0087	.0011	
144,342	1,100	.0165	.....	
157,464	1,200	.0183	.....	
170,586	1,300	.0200	.....	
183,708	1,400	.0220	.....	
196,830	1,500	.0240	.0018	
.....	600	.0100	.0018	
.....	600	.0100	.0018	
209,952	1,600	.0261	.....	
223,074	1,700	.0280	.....	
236,196	1,800	.0300	.....	
249,318	1,900	.0318	.....	
262,440	2,000	.0340	.0030	E (1,000-2,000) = 2,857,000 pounds per square inch.
.....	600	.0120	.0029	
.....	600	.0120	.0029	
275,562	2,100	.0365	.....	
288,684	2,200	.0386	.....	
301,806	2,300	.0420	.....	
314,928	2,400	.0445	.0051	
.....	600	.0152	.0050	
.....	600	.0151	.0050	
380,000	2,896	.....	.....	Ultimate strength.

Pier failed by opening longitudinal cracks along the middle of its height.

No. 1827.

12″ FACE BRICK PIER.

Red, wire-cut face brick, same as used in pier No. 1826.

Material received from Saco Brick Company, Saco, Me.

Built of 39 courses of brick, with solid core. Joints broken every six courses.

Laid in cement mortar—1 part Saylor's Portland cement and 1 part sand.

Age, 3 months 6 days.

Weight, 980 pounds = 131.9 pounds per cubic foot.

Height of pier, 96.75 inches.

Sectional area, 11″.52 × 11″.52 = 132.71 square inches.

Average thickness of joints, ″.32.

Gauged length, 50″.

The bed joints of this pier were not well filled with mortar.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
13,271	100	0.	0.	Initial load. Loaded with 6,000 pounds before testing.
19,907	150	.0008	.0003	
26,542	200	.0019	.0005	
33,178	250	.0026	.0007	
39,813	300	.0036	.0009	
46,449	350	.0045	.0010	
53,084	400	.0053	.0014	
59,720	450	.0062	.0015	
66,355	500	.0071	.0017	
72,991	550	.0080	.0021	
79,626	600	.0091	.0021	E (100–600) = 3,571,000 pounds per square inch.
.....	600	.0091	.0021	
86,262	650	.0101	.....	
92,897	700	.0109	.....	
99,533	750	.0119	.....	
106,168	800	.0127	.....	
112,804	850	.0138	.....	
119,439	900	.0147	.....	
126,075	950	.0158	.....	
132,710	1,000	.0169	.0032	E (600–1,000) = 2,985,000 pounds per square inch.
.....	600	.0106	.0032	
.....	600	.0106	.0035	
145,981	1,100	.0188	.....	
159,252	1,200	.0209	.....	Snapping sounds.
172,523	1,300	.0229	.....	
185,794	1,400	.0248	.....	
199,065	1,500	.0270	.0050	
.....	600	.0131	.0050	
.....	600	.0130	.0047	
212,336	1,600	.0290	.....	
225,607	1,700	.0309	.....	
238,878	1,800	.0329	.....	
252,149	1,900	.0348	.....	
265,420	2,000	.0373	.0062	E (1,000–2,000) = 2,874,000 pounds per square inch.
.....	600	.0154	.0063	
.....	600	.0155	.0064	
278,691	2,100	.0398	.....	
291,962	2,200	.0420	.....	
305,233	2,300	.0445	.....	
318,504	2,400	.0470	.....	
331,775	2,500	.0497	.0089	
.....	600	.0189	.0089	
.....	600	.0189	.0089	
392,000	2,954	.....	.....	Ultimate strength.

Pier fails along the middle of its height, opening longitudinal cracks which separated the bricks into halves.

No. 1822.

11″.5 FACE BRICK PIER.

Wire-cut, face brick.
Material received from the Saco Brick Company, Saco, Me.
Built of 39 courses of brick, with hollow core.
Laid in cement mortar—1 part Saylor's Portland cement and 1 part sand.
Age, 3 months 8 days.
Weight, 833 pounds = 134.8 pounds per cubic foot.
Height of pier, 95.80 inches.
Outside dimensions, 11″.38 × 11″.52 = 131.10 square inches.
Core, 4″.40 × 4″.48 = 19.71 square inches.
Net sectional area, 111.39 square inches.
Average thickness of joints, ″.30.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
11,139	100	0.	0.	Initial load. Loaded with 16,000 pounds before testing.
16,709	150	.0006	0.	
22,278	200	.0013	0.	
27,848	250	.0019	.0001	
33,417	300	.0026	.0001	
38,987	350	.0032	.0002	
44,556	400	.0040	.0004	
50,126	450	.0047	.0004	
55,695	500	.0053	.0005	
61,265	550	.0059	.0005	
66,834	600	.0066	.0006	E (100-600) = 4,167,000 pounds per square inch.
.....	600	.0068	.0006	
72,404	650	.0074	.....	
77,973	700	.0082	.....	
83,543	750	.0088	.....	
89,112	800	.0097	.....	
94,682	850	.0103	.....	
100,251	900	.0110	.....	
105,821	950	.0119	.....	
111,390	1,000	.0127	.0009	Snapping sounds. E (600-1,000) = 3,448,000 pounds per square inch.
.....	600	.0073	.0010	
.....	600	.0073	.0010	
122,529	1,100	.0143	.....	
133,668	1,200	.0158	.....	
144,807	1,300	.0177	.....	
155,946	1,400	.0193	.....	
167,085	1,500	.0211	.0017	
.....	600	.0083	.0014	
.....	600	.0083	.0014	
178,224	1,600	.0230	.....	
189,363	1,700	.0246	.....	
200,502	1,800	.0266	.....	
211,641	1,900	.0283	.....	
222,780	2,000	.0300	.0024	E (1,000-2,000) = 3,165,009 pounds per square inch.
.....	600	.0095	.0024	
.....	600	.0095	.0024	
233,919	2,100	.0323	.....	
245,058	2,200	.0339	.....	
256,197	2,300	.0358	.....	
267,336	2,400	.0378	.....	
278,475	2,500	.0396	.0032	

No. 1822—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
.....	600	.0110	.0031	
.....	600	.0110	.0031	
289,614	2,600	.0424	.....	
300,753	2,700	.0444	.....	
311,892	2,800	.0470	.0043	
.....	600	.0126	.0043	
.....	600	.0124	.0043	
354,000	3,178	.....	.....	Ultimate strength.

Pier failed in the lower half. Longitudinal cracks developed, separating the bricks into halves.

No. 1782.

12" FACE BRICK PIER.

Wire-cut, red face brick, furnished by Messrs. Fiske & Co., of Boston, from their Dover, N. H., yard.
Pier built of 37 courses of brick, with hollow core.
Laid in neat Saylor's Portland cement.
Age, 2 months.
Weight, 797 pounds = 135.3 pounds per cubic foot.
Height of pier, 94.45 inches.
Outside dimensions, 11".40 × 11".32 = 129.05 square inches.
Core, 4".74 × 4".50 = 21.33 square inches.
Net sectional area, 107.72 square inches.
Gauged length, 50".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
10,772	100	0.	0.	Initial load. Loaded with 11,000 pounds before testing.
16,158	150	.0010	0.	
21,544	200	.0020	0.	
26,930	250	.0030	.0002	
32,316	300	.0044	.0004	
37,702	350	.0055	.0005	
43,088	400	.0065	.0006	
48,474	450	.0078	.0008	
53,860	500	.0090	.0008	
59,246	550	.0100	.0010	
64,632	600	.0113	.0011	E (100-600) = 2,451,000 pounds per square inch.
.....	600	.0111	.0011	
70,018	650	.0125	.0014	
75,404	700	.0137	.0015	
80,790	750	.0148	.0016	
86,176	800	.0160	.0018	
91,562	850	.0172	.0020	
96,948	900	.0184	.0020	
102,334	950	.0197	.0023	
107,720	1,000	.0210	.0025	E (600-1,000) = 2,410,000 pounds per square inch.
20,000	.....	.....	.....	Pier rested under this load 26 hours.
.....	600	.0131	.0025	
.....	600	.0129	.0026	
118,492	1,100	.0235	.0029	
129,264	1,200	.0259	.0031	
140,036	1,300	.0281	.0033	
150,808	1,400	.0305	.0036	
161,580	1,500	.0328	.0038	
.....	600	.0148	.0038	
.....	600	.0148	.0037	
172,352	1,600	.0351	.0039	
183,124	1,700	.0374	.0040	
193,896	1,800	.0399	.0042	
204,668	1,900	.0425	.0047	
215,440	2,000	.0452	.0049	E (1,000-2,000) = 2,294,000 pounds per square inch.
.....	600	.0170	.0050	
.....	600	.0170	.0050	
226,212	2,100	.0478	.....	
236,984	2,200	.0500	.....	
247,756	2,300	.0525	.....	
258,528	2,400	.0548	.....	
269,300	2,500	.0573	.0062	

No. 1782—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
.....	600	.0185	.0062	
.....	600	.0185	.0062	
280,072	2,600	.0598	.....	
290,844	2,700	.0625	.....	
301,616	2,800	.0652	.....	
312,388	2,900	.0676	.....	
323,160	3,000	.0704	.0079	E (2,000-3,000)=2,252,000 pounds per square inch.
.....	600	.0111	.0080	
.....	600	.0111	.0080	
333,932	3,100	.0740	.....	
344,704	3,200	.0769	.....	Snapping sounds.
355,476	3,300	.0798	.....	
366,248	3,400	.0830	.0099	
370,000	3,435	.....	.....	Ultimate strength.

Pier fractured suddenly, breaking up into half bricks and smaller fragments along its full height, excepting about 2 feet at lower end.

No. 1820.

11".5 WIRE-CUT BRICK PIER.

Red, wire-cut brick.
Built of 36 courses of brick, with hollow core.
Laid in cement mortar—1 part Saylor's Portland cement and 1 part sand.
Age, 5 months 22 days.
Weight, 804 pounds = 136.5 pounds per cubic foot.
Height of pier, 94.57 inches.
Outside dimensions, 11".35 × 11".40 = 129.39 square inches.
Core, 4".65 × 4".67 = 21.71 square inches.
Net sectional area, 107.68 square inches.
Average thickness of joints, ".27.
Gauged length 50".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
10,768	100	0.	0.	Initial load. Loaded with 10,000 pounds before testing.
16,152	150	.0006	0.	
21,536	200	.0012	0.	
26,920	250	.0020	0.	
32,304	300	.0029	.0001	
37,688	350	.0036	.0001	
43,072	400	.0044	.0001	
48,456	450	.0052	.0002	
53,840	500	.0061	.0003	
59,224	550	.0071	.0004	
64,608	600	.0080	.0005	E (100-600) = 3,333,000 pounds per square inch.
.....	600	.0080	.0006	
69,992	650	.0089	.....	
75,376	700	.0099	.....	
80,760	750	.0109	.....	
86,144	800	.0117	.....	
91,528	850	.0129	.....	Snapping sounds.
96,912	900	.0139	.....	
102,296	950	.0149	.....	
107,680	1,000	.0161	.0009	E (600-1,000) = 2,597,000 pounds per square inch.
.....	.....	.....	.0002	Set after resting 45 minutes.
.....	600	.0081	.0002	
.....	600	.0081	.0004	
118,448	1,100	.0179	.....	
129,216	1,200	.0199	.....	
139,984	1,300	.0212	.....	
150,752	1,400	.0246	.....	
161,520	1,500	.0267	.0012	
.....	600	.0096	.0011	
.....	600	.0096	.0012	
172,288	1,600	.0291	.....	
183,056	1,700	.0315	.....	
193,824	1,800	.0336	.....	
204,592	1,900	.0360	.....	
215,360	2,000	.0385	.0021	E (1,000-2,000) = 2,358,000 pounds per square inch.
.....	600	.0113	.0022	
.....	600	.0111	.0021	
226,128	2,100	.0412	.....	
236,896	2,200	.0439	.....	
247,664	2,300	.0470	.....	Ultimate strength.

Pier failed in the upper half. Opened longitudinal cracks, separating the bricks into halves.

No. 1816.

12" WIRE-CUT BRICK PIER.

Wire-cut brick; red color.
Built of 37 courses of brick, with hollow core.
Laid in cement mortar—1 part Alpha cement and 2 parts sand.
Age, 2 years.
Weight, 932 pounds = 139.5 pounds per cubic foot.
Height of pier, 96.32 inches.
Outside dimensions, 11".85 × 11".90 = 141.02 square inches.
Core, 4".6 × 4".6 = 21".16 square inches.
Net sectional area, 119.86 square inches.
Average thickness of joints, ".28.
Gauged length, 50".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
11,986	100	0.	0.	Initial load. Loaded with 10,000 pounds before testing.
17,979	150	.0010	0.	
23,972	200	.0019	.0001	
29,965	250	.0027	.0002	
35,958	300	.0039	.0003	
41,951	350	.0049	.0006	
47,944	400	.0060	.0006	
53,937	450	.0070	.0007	
59,930	500	.0080	.0008	
65,923	550	.0090	.0010	
71,916	600	.0101	.0012	E (100-600) = 2,809,000 pounds per square inch.
.....	600	.0101	.0011	
77,909	650	.0114	.....	
83,902	700	.0124	.....	
89,895	750	.0136	.....	
95,888	800	.0147	.....	
101,881	850	.0160	.....	
107,877	900	.0171	.....	
113,867	950	.0184	.....	
119,860	1,000	.0195	.0019	E (600-1,000) = 2,299,000 pounds per square inch.
.....	600	.0115	.0019	
.....	600	.0114	.0019	
131,846	1,100	.0222	.....	
143,832	1,200	.0237	.....	
155,818	1,300	.0269	.....	
167,804	1,400	.0292	.....	
179,790	1,500	.0320	.0030	
.....	600	.0132	.0030	
.....	600	.0132	.0030	
191,776	1,600	.0346	.....	
203,762	1,700	.0369	.....	
215,748	1,800	.0394	.....	
227,734	1,900	.0421	.....	
239,720	2,000	.0448	.0043	E (1,000-2,000) = 2,183,000 pounds per square inch.
.....	600	.0152	.0042	
.....	600	.0152	.0042	
251,706	2,100	.0484	.....	Snapping sounds.
263,692	2,200	.0510	.....	
275,678	2,300	.0538	.....	
287,664	2,400	.0564	.....	
299,650	2,500	.0591	.0061	
.....	600	.0180	.0061	
.....	600	.0180	.0061	

No. 1816—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
311,636	2,600	.0630	.....	
323,622	2,700	.0659	.....	
335,608	2,800	.0690	.....	
347,594	2,900	.0734	.....	
359,580	3,000	.0760	.0090	E (2,000–3,000)=1,887,000 pounds per square inch.
.....	600	.0217	.0090	
.....	600	.0219	.0090	
.....	600	.0216	.....	
.....	1,000	.0313	.....	
.....	1,500	.0434	.....	
.....	2,000	.0547	.....	
.....	1,500	.0445	.....	
.....	1,000	.0330	.....	
.....	600	..232	.0090	
.....	600	.0220	.0090	
391,000	3,262	.....	.....	Ultimate strength.

Pier failed along the middle of its height. Bricks crushed in middle courses and longitudinal cracks developed.

No. 1817.

12" FACE BRICK PIER.

Gray face brick.
Brand, "W. G. B. Co." Paneled.
Built of 39 courses of brick, with hollow core.
Laid in neat Saylor's Portland cement.
Age, 5 months 24 days.
Weight, 1,045 pounds = 139.5 pounds per cubic foot.
Height of pier, 95.65 inches.
Outside dimensions, 12".50 × 12".54 = 156.75 square inches.
Core, 4".50 × 4".55 = 20.47 square inches.
Net sectional area, 135.28 square inches.
Average thickness of joints, ".20.
Gauged length, 50".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
13,528	100	0.	0.	Initial load. Loaded with 10,000 pounds before testing.
20,292	150	.0007	0.	
27,056	200	.0014	.0001	
33,820	250	.0020	.0001	
40,584	300	.0026	.0002	
47,348	350	.0030	0.	
54,112	400	.0035	.0003	
60,876	450	.0043	0.	
67,640	500	.0049	.0002	
74,404	550	.0054	.0003	
81,168	600	.0060	.0004	E (100-600)=4,464,000 pounds per square inch.
.....	600	.0060	.0003	
87,932	650	.0066	.....	
94,696	700	.0071	.....	
101,460	750	.0078	.....	
108,224	800	.0083	.....	
114,988	850	.0090	.....	
121,752	900	.0096	.....	
128,516	950	.0102	.....	
135,280	1,000	.0109	.0008	E (600-1,000)=4,444,000 pounds per square inch.
.....	600	.0068	.0008	
.....	600	.0069	.0008	
148,808	1,100	.0123	.....	
162,336	1,200	.0137	.....	
175,864	1,300	.0149	.....	
189,392	1,400	.0162	.....	
202,920	1,500	.0177	.0013	
.....	600	.0080	.0013	
.....	600	.0079	.0011	
216,448	1,600	.0192	.....	
229,976	1,700	.0203	.....	
243,504	1,800	.0216	.....	
257,032	1,900	.0230	.....	
270,560	2,000	.0244	.0017	E (1,000-2,000)=3,968,000 pounds per square inch.
.....	600	.0088	.0017	
.....	600	.0088	.0017	
284,088	2,100	.0260	.....	
297,616	2,200	.0274	.....	
311,144	2,300	.0287	.....	
324,672	2,400	.0300	.....	
338,200	2,500	.0312	.0022	

No. 1817—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
.....	600	.0100	.0022	
.....	600	.0100	.0022	
351,728	2,600	.0330	.....	
365,256	2,700	.0345	.....	
378,784	2,800	.0357	.....	
392,312	2,900	.0371	.....	
405,840	3,000	.0385	.0032	E (2,000-3,000)=3,968,000 pounds per square inch.
.....	600	.0112	.0032	
.....	600	.0112	.0032	
574,000	4,243	.....	.....	Ultimate strength.

Opened longitudinal cracks along middle of height of pier.

No. 1818.

12" FACE BRICK PIER.

Gray face brick.
Brand: "W. G. B. Co." Paneled.
Built of 38 courses of brick, with hollow core.
Laid in cement mortar—1 part Saylor's Portland cement and 1 part sand.
Age, 5 months 21 days.
Weight, 1,061 pounds = 138.2 pounds per cubic foot.
Height of pier, 96.30 inches.
Outside dimensions, 12".56 × 12".56 = 157.75 square inches.
Core, 4".40 × 4".50 = 19.80 square inches.
Net sectional area, 137.95 square inches.
Average thickness of joints, ".20.
Gauged length, 50".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
13,795	100	0.	0.	Initial load. Loaded with 8,000 pounds before testing.
20,693	150	.0001	0.	
27,590	200	.0005	0.	
34,488	250	.0010	0.	
41,385	300	.0015	0.	
48,283	350	.0020	0.	
55,180	400	.0025	0.	
62,078	450	.0030	.0001	
68,975	500	.0036	.0001	
75,873	550	.0041	.0001	
82,770	600	.0046	.0002	E (100-600) = 5,682,000 pounds per square inch.
.....	600	.0046	.0002	
89,668	650	.0053	.....	
96,565	700	.0059	.....	
103,463	750	.0065	.....	
110,360	800	.0069	.....	
117,258	850	.0075	.....	
124,155	900	.0081	.....	
131,053	950	.0086	.....	
137,950	1,000	.0093	.0004	E (600-1,000) = 4,444,000 pounds per square inch.
.....	600	.0050	.0004	
.....	600	.0050	.0004	
151,745	1,100	.0103	.....	
165,540	1,200	.0114	.....	
179,335	1,300	.0126	.....	
193,130	1,400	.0138	.....	
206,925	1,500	.0150	.0007	
.....	600	.0056	.0006	
.....	600	.0056	.0007	
220,720	1,600	.0165	.....	
234,515	1,700	.0177	.....	
248,310	1,800	.0189	.....	Snapping sounds.
262,105	1,900	.0201	.....	
275,900	2,000	.0215	.0012	E (1,000-2,000) = 4,386,000 pounds per square inch.
.....	600	.0065	.0011	
.....	600	.0065	.0011	
289,695	2,100	.0229	.....	
303,490	2,200	.0241	.....	
317,285	2,300	.0255	.....	
331,080	2,400	.0268	.....	
344,875	2,500	.0280	.0017	

No. 1818—Continued.

Applied loads		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
.....	600	.0074	0017	
.....	600	.0074	.0016	
358,670	2,600	.0298	.....	
372,465	2,700	.0311	.....	
386,260	2,800	.0325	.....	
400,055	2,900	.0339	.....	
413,850	3,000	.0352	.0025	E (2,000–3,000) = 4,032,000 pounds per square inch.
.....	600	.0087	.0025	
.....	600	.0087	.0025	
20,000	.....	.....	.....	Pier remained under this load 18 hours.
.....	100	.....	.0011	
.....	600	.0071	.0011	
.....	600	.0071	.....	
.....	1,000	.0117	.....	
.....	1,500	.0175	.....	
.....	2,000	.0231	.....	
.....	2,500	.0285	.....	
.....	2,000	.0238	.....	
.....	1,500	.0185	.....	
.....	1,000	.0129	.....	
.....	600	.0082	.0015	
.....	600	.0079	.0015	
590,000	4,277	.....	.....	Ultimate strength.

Pier failed along middle of its height. Individual brick partially crushed and longitudinal cracks developed.

No. 1819.

11″ FACE BRICK PIER.

Gray face brick.
Brand: "W. G. B. Co." Paneled.
Built of 22 courses of brick, with hollow core. Bricks laid on edge.
Laid in cement mortar—1 part Saylor's Portland cement and 1 part sand.
Age, 5 months 21 days.
Weight, 603 pounds = 141.9 pounds per cubic foot.
Height of pier, 93.57 inches.
Outside dimensions, 10″.89 × 10″.99 = 119.68 square inches.
Core, 6″.37 × 6″.47 = 41.21 square inches.
Net sectional area, 78.47 square inches.
Average thickness of joints, ″.18.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
7,847	100	0.	0.	Initial load. Loaded with 5,000 pounds before testing.
11,771	150	.0004	0.	
15,694	200	.0008	.0001	
19,618	250	.0012	.0003	
23,541	300	.0019	.0003	
27,465	350	.0025	.0005	
31,388	400	.0032	.0007	
35,312	450	.0039	.0008	
39,235	500	.0044	.0008	
43,159	550	.0049	.0009	
47,082	600	.0056	.0010	E (100-600) = 5,435,000 pounds per square inch.
.....	600	.0057	.0010	
51,006	650	.0062	.....	
54,927	700	.0069	.....	
58,853	750	.0076	.....	
62,776	800	.0082	.....	
66,700	850	.0088	.....	
70,623	900	.0094	.....	
74,547	950	.0099	.....	
78,470	1,000	.0105	.0016	E (600-1,000) = 4,651,000 pounds per square inch.
.....	600	.0067	.0016	
.....	600	.0066	.0016	
86,317	1,100	.0120	.....	Snapping sounds.
94,164	1,200	.0133	.....	
102,011	1,300	.0145	.....	
109,858	1,400	.0160	.....	
117,705	1,500	.0174	.0024	
.....	600	.0079	.0024	
.....	600	.0079	.0023	
125,552	1,600	.0191	.....	
133,399	1,700	.0206	.....	
141,246	1,800	.0220	.....	
149,093	1,900	.0235	.....	
156,940	2,000	.0250	.0033	E (1,000-2,000) = 3,906,000 pounds per square inch.
.....	600	.0095	.0033	
.....	600	.0095	.0031	
164,787	2,100	.0270	.....	
172,634	2,200	.0283	.....	

No. 1819—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
180,481	2,300	.0298	.....	
188,328	2,400	.0314	.....	
196,175	2,500	.0330	.0047	
.....	600	.0112	.0047	
.....	600	.0112	.0047	
204,022	2,600	.0353	.....	
211,869	2,700	.0370	.....	
219,716	2,800	.0387	.....	
227,563	2,900	.0410	.....	
235,410	3,000	.0432	.0073	E (2,000-3,000)=3,546,000 pounds per square inch.
.....	600	.0146	.0072	
.....	600	.0145	.0072	
277,600	3,538	.....	.....	Ultimate strength.

Brick partially crushed in two courses near middle of height. Opened longitudinal cracks, one of which extended nearly the full height of the pier.

No. 1830.

12″ FACE BRICK PIER.

Light cream colored face brick, wire-cut on bed surfaces.
Built of 36 courses of brick, with hollow core.
Laid in cement mortar—1 part Saylor's Portland cement and 1 part sand.
Age, 2 months 16 days.
Weight, 1,001 pounds = 134.9 pounds per cubic foot.
Height of pier, 95.25 inches.
Outside dimensions, 12″.43 × 12″.44 = 154.63 square inches.
Core, 4″.45 × 4″.50 = 20.03 square inches.
Net sectional area, 134.60 square inches.
Average thickness of joints, ″.32.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
13,460	100	0.	0.	Initial load. Loaded with 8,000 pounds before testing.
20,190	150	.0005	0.	
26,920	200	.0007	0.	
33,650	250	.0010	.0001	
40,380	300	.0014	.0001	
47,110	350	.0019	.0001	
53,840	400	.0024	.0001	
60,570	450	.0027	.0002	
67,300	500	.0031	.0001	
74,030	550	.0038	.0002	
80,760	600	.0041	.0002	E (100-600)=6,410,000 pounds per square inch.
.....	600	.0041	.0002	
87,490	650	.0047	.....	
94,220	700	.0051	.....	
100,950	750	.0055	.....	
107,680	800	.0060	.....	
114,410	850	.0065	.....	
121,140	900	.0070	.....	
127,870	950	.0075	.....	
134,600	1,000	.0080	.0004	E (600-1,000)=5,405,000 pounds per square inch.
.....	600	.0044	.0004	
.....	600	.0045	.0004	
148,060	1,100	.0090	.....	
161,520	1,200	.0098	.....	Snapping sounds.
174,980	1,300	.0109	.....	
188,440	1,400	.0119	.....	
201,900	1,500	.0129	.0007	
.....	600	.0049	.0007	
.....	600	.0050	.0007	
215,360	1,600	.0140	.....	
228,820	1,700	.0150	.....	
242,280	1,800	.0161	.....	
255,740	1,900	.0175	.....	
269,200	2,000	.0188	.0011	E (1,000-2,000)=4,950,000 pounds per square inch.
.....	600	.0056	.0011	
.....	600	.0056	.0010	
282,660	2,100	.0201	.....	
296,120	2,200	.0214	.....	
309,580	2,300	.0227	.....	
323,040	2,400	.0240	.....	
336,500	2,500	.0251	.0018	

No. 1830—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
.....	600	.0065	.0017	
.....	600	.0065	.0017	
.....	600	.0065	.....	
.....	1,000	.0104	.....	
.....	1,500	.0155	.....	
.....	2,000	.0206	.....	
.....	1,500	.0159	.....	
.....	1,000	.0110	.....	
.....	600	.0070	.0019	
433,000	3,217	.....	.....	Ultimate strength.

Opened longitudinal cracks along upper half of the pier.

No. 1833.

12" FACE BRICK PIER.

Light cream colored face brick, wire-cut on bed surfaces, same as used in piers Nos. 1830, 1831, and 1832.

Built of 37 courses of brick, laid flatwise. Joints broken every six courses. Hollow core.

Laid in cement mortar—1 part Saylor's Portland cement and 1 part sand.

Age, 2 months 21 days.

Weight, 1,007 pounds = 135.5 pounds per cubic foot.

Height of pier, 95.65 inches.

Outside dimensions, $12''.47 \times 12''.48 = 154.38$ square inches.

Core, $4''.47 \times 4''.52 = 20.20$ square inches.

Net sectional area, 134.18 square inches.

Average thickness of joints, $''.25$.

Gauged length, 50".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
13,418	100	0.	0.	Initial load. Special load of 94,000 pounds applied before testing.
20,127	150	.0007	.....	
26,836	200	.0013	.....	
33,545	250	.0020	.....	
40,254	300	.0025	.....	
46,963	350	.0030	.....	
53,672	400	.0035	.....	
60,381	450	.0040	.....	
67,090	500	.0044	.....	
73,790	550	.0048	.....	
80,508	600	.0052	.0003	E (100-600) = 5,102,000 pounds per square inch.
.....	600	.0051	.0003	
87,217	650	.0054	.....	
93,926	700	.0058	.....	
100,635	750	.0064	.....	
107,344	800	.0068	.....	
114,053	850	.0071	.....	
120,762	900	.0076	.....	
127,471	950	.0080	.....	
134,180.	1,000	.0085	.0004	Snapping sounds. E(600-1,000) = 6,250,000 pounds per square inch.
.....	600	.0055	.0005	
.....	600	.0055	.0006	
147,598	1,100	.0095	.....	
161,016	1,200	.0106	.....	
174,434	1,300	.0114	.....	
187,852	1,400	.0124	.....	
201,270	1,500	.0136	.0011	
.....	600	.0059	.0011	
.....	600	.0059	.0011	
214,688	1,600	.0146	.....	
228,106	1,700	.0160	.....	
241,524	1,800	.0173	.....	
254,942	1,900	.0185	.....	
268,360	2,000	.0195	.0019	E (1,000-2,000) = 5,263,000 pounds per square inch.
.....	600	.0070	.0018	
.....	600	.0070	.0019	
281,778	2,100	.0214	.....	
295,196	2,200	.0225	.....	
308,614	2,300	.0238	.....	
322,032	2,400	.0251	.....	
335,450	2,500	.0264	.0028	No cracks visible in the brickwork at this time.
.....	600	.0083	.0027	
.....	600	.0083	.0028	
463,000	3,451	.....	.....	Ultimate strength.

Opened longitudinal cracks along middle of height of pier.

No. 1832.

11″ FACE BRICK PIER.

Light cream colored face brick, wire-cut on bed surfaces, same as used in piers Nos. 1830 and 1831.

Built of 23 courses of brick, laid on edge. Joints broken every course. Hollow core.

Laid in cement mortar—1 part Saylor's Portland cement and 1 part sand.

Age, 2 months 21 days.

Weight, 609 pounds = 138.4 pounds per cubic foot.

Height of pier, 96.65 inches.

Outside dimensions, 10″.80 × 10″.87 = 117.40 square inches.

Core, 6″.19 × 6″.26 = 38.75 square inches.

Net sectional area, 78.65 square inches.

Average thickness of joints, ″.28.

Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
7,865	100	0.	0.	Initial load. Loaded with 6,000 pounds before testing.
11,798	150	.0004	0.	
15,730	200	.0006	0.	
19,663	250	.0010	0.	
23,595	300	.0015	0.	
27,528	350	.0019	0.	
31,460	400	.0023	.0001	
35,393	450	.0027	.0001	
39,325	500	.0031	.0001	
43,258	550	.0035	.0001	
47,190	600	.0040	.0002	E(100-600) = 6,579,000 pounds per square inch.
.....	600	.0040	.0003	
51,123	650	.0044	.....	
55,055	700	.0048	.....	
58,988	750	.0054	.....	
62,920	800	.0058	.....	
66,853	850	.0064	.....	
70,785	900	.0067	.....	
74,718	950	.0073	.....	
78,650	1,000	.0078	.0007	E(600-1,000) = 6,061,000 pounds per square inch.
.....	600	.0045	.0006	
.....	600	.0045	.0007	
86,515	1,100	.0088	.....	
94,380	1,200	.....	.....	
102,245	1,300	.0097	.....	
110,110	1,400	.0119	.....	
117,975	1,500	.0128	.0011	
.....	600	.0055	.0013	
.....	600	.0055	.0015	
125,840	1,600	.0143	.....	
133,705	1,700	.0152	.....	
141,570	1,800	.0163	.....	Snapping sounds.
149,435	1,900	.0175	.....	
157,300	2,000	.0187	.0024	E(1,600-2,000) = 5,435,000 pounds per square inch.
.....	600	.0068	.0024	
.....	600	.0067	.0024	
165,165	2,100	.0200	.....	
173,030	2,200	.0225	.....	
180,895	2,300	.0230	.....	
188,760	2,400	.0242	.....	
196,625	2,500	.0254	.0036	

No. 1832—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
.....	600	.0081	.0036	
.....	600	.0081	.0036	
204,490	2,600	.0274	.....	
212,355	2,700	.0289	.....	
220,220	2,800	.0307	.....	
228,085	2,900	.0319	.....	
235,950	3,000	.0335	.0060	E (2,000-3,000)=3,788,000 pounds per square inch.
.....	600	.0108	.0055	
.....	600	.0108	.0058	
363,500	4,622	.....	.....	Ultimate strength.

Opened longitudinal cracks along middle of height of pier.

No. 1831.

11" FACE BRICK PIER.

Light cream colored face brick, wire-cut on bed surfaces, same as in pier No. 1830.

Built of 23 courses of brick, laid on edge. Joints broken every 3 courses. Hollow core.

Laid in cement mortar—1 part Saylor's Portland cement and 1 part sand.

Age, 2 months 16 days.

Weight, 607 pounds = 144.9 pounds per cubic foot.

Height of pier, 96.10 inches.

Outside dimensions, $10''.75 \times 10''.75 = 115.56$ square inches.

Core, $6''.29 \times 6''.39 = 40.19$ square inches.

Net sectional area, 75.37 square inches.

Average thickness of joints, $''.18$.

Gauged length, $50''$.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
7,537	100	0.	0.	Initial load. Loaded with 6,500 pounds before testing.
11,306	150	.0002	0.	
15,074	200	.0007	0.	
18,843	250	.0010	0.	
22,611	300	.0014	0.	
26,380	350	.0018	.0003	
30,148	400	.0023	.0004	
33,917	450	.0027	.0004	
37,685	500	.0031	.0004	
41,454	550	.0035	.0005	
45,222	600	.0040	.0005	E (100-600) = 7,143,000 pounds per square inch.
.....	600	.0040	.0005	
48,991	650	.0044	.....	
52,759	700	.0048	.....	
56,528	750	.0051	.....	
60,296	800	.0056	.....	
64,065	850	.0060	.....	
67,833	900	.0065	.....	
71,602	950	.0069	.....	
75,370	1,000	.0073	.0009	E (600-1,000) = 6,897,000 pounds per square inch.
.....	600	.0043	.0009	
.....	600	.0043	.0009	
82,907	1,100	.0083	.....	
90,444	1,200	.0091	.....	
97,981	1,300	.0100	.....	
105,518	1,400	.0110	.....	
113,055	1,500	.0119	.0014	Snapping sounds.
.....	600	.0050	.0014	
.....	600	.0050	.0014	
120,592	1,600	.0128	.....	
128,129	1,700	.0139	.....	
135,666	1,800	.0148	.....	
143,203	1,900	.0159	.....	
150,740	2,000	.0170	.0020	E (1,000-2,000) = 5,814,000 pounds per square inch.
.....	600	.0058	.0021	
.....	600	.0059	.0022	
158,277	2,100	.0183	.....	
165,814	2,200	.0193	.....	
173,351	2,300	.0205	.....	
180,888	2,400	.0217	.....	
188,425	2,500	.0227	.0029	

No. 1831—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
.....	600	.0069	.0030	
.....	600	.0069	.0028	
.....	600	.0069	.....	
.....	1,000	.0101	.....	
.....	1,500	.0142	.....	
.....	2,000	.0186	.....	
.....	1,500	.0146	.....	
.....	1,000	.0105	.....	
.....	600	.0073	.0030	
381,000	5,055	.....	.....	Ultimate strength.

Pier failed by the development of longitudinal cracks and the crushing of individual bricks. During the later stages of the test snapping sounds increased in frequency as the cracks in the bricks developed; finally the pier burst explosively into a large number of fragments.

No. 1823.

11".5 SAND-STRUCK BRICK PIER.

Sand-struck brick. One side paneled; other side wire-cut.

Material received from Stiles & Hart Co., North Haven, Conn.

Built of 38 courses of brick, with solid core. Bricks used in core were laid on end.

Laid in cement mortar—1 part Saylor's Portland cement and 1 part sand.

Age, 3 months 10 days.

Weight, 962 pounds = 128.6 pounds per cubic foot.

Height of pier, 95.65 inches.

Sectional area, 11".60 × 11".65 = 135.14 square inches.

Average thickness of joints, ".30.

Gauged length, 50".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
13,514	100	0.	0.	Initial load. Loaded with 9,000 pounds before testing.
20,271	150	.0008	0.	
27,028	200	.0019	0.	
33,785	250	.0029	.0001	
40,542	300	.0039	.0004	
47,299	350	.0050	.0005	
54,056	400	.0060	.0005	
60,813	450	.0071	.0005	
67,570	500	.0081	.0006	
74,327	550	.0091	.0007	
81,084	600	.0102	.0009	E (100–600) = 2,688,000 pounds per square inch.
.....	600	.0104	.0008	
87,841	650	.0115	.....	
94,598	700	.0127	.....	
101,355	750	.0138	.....	
108,112	800	.0149	.....	
114,869	850	.0161	.....	
121,626	900	.0173	.....	
128,383	950	.0186	.....	
135,140	1,000	.0198	.0015	E (600–1,000) = 2,222,000 pounds per square inch.
.....	600	.0113	.0015	
.....	600	.0113	.0015	
148,654	1,100	.0223	.....	
162,168	1,200	.0247	.....	
175,682	1,300	.0270	.....	
189,196	1,400	.0294	.....	
202,710	1,500	.0316	.0022	
.....	600	.0124	.0022	
.....	600	.0124	.0022	
216,224	1,600	.0341	.....	
229,738	1,700	.0365	.....	
243,252	1,800	.0390	.....	
256,766	1,900	.0416	.....	
270,280	2,000	.0444	.0032	E (1,000–2,000) = 2,183,000 pounds per square inch.
.....	600	.0140	.0033	
.....	600	.0140	.0032	
283,794	2,100	.0477	.....	Snapping sounds.
297,308	2,200	.0500	.....	
310,822	2,300	.0524	.....	
324,336	2,400	.0550	.....	
337,850	2,500	.0576	.0045	

No. 1823—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
.....	600	.0159	.0044	
.....	600	.0159	.0044	
351,364	2,600	.0610	.....	
364,878	2,700	.0638	.....	
378,392	2,800	.0669	.....	
391,906	2,900	.0698	.....	
405,420	3,000	.0725	.0064	E (2,000-3,000)=2,008,000 pounds per square inch.
.....	600	.0184	.0063	
.....	600	.0183	.0063	
464,000	3,433	.....	.....	Ultimate strength.

Pier failed along middle of height and in upper half. Opened longitudinal cracks.

No. 1824.

11".5 SAND-STRUCK BRICK PIER.

Sand-struck brick, same as used in pier No. 1823.

Material received from Stiles & Hart Co., North Haven, Conn.

Built of 38 courses of brick, with solid core. Core filled with half-brick.

Laid in cement mortar—1 part Saylor's Portland cement and 1 part sand.

Age, 3 months 9 days.

Weight, 965 pounds = 127.6 pounds per cubic foot.

Height of pier, 96.55 inches.

Sectional area, 11".56 × 11".70 = 135.25 square inches.

Average thickness of joints, ".28

Gauged length, 50".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
13,525	100	0.	0.	Initial load. Loaded with 10,000 pounds before testing.
20,288	150	.0009	0.	
27,050	200	.0020	.0001	
33,813	250	.0031	.0004	
40,575	300	.0042	.0004	
47,338	350	.0055	.0007	
54,100	400	.0068	.0009	
.....	100	.....	.0012	Apparent set after resting under initial load 16 hours.
60,863	450	.0083	.0014	
67,625	500	.0095	.0015	
74,388	550	.0106	.0017	
81,150	600	.0120	.0018	E (100–600) = 2,450,000 pounds per square inch.
.....	600	.0121	.0020	
87,913	650	.0135	.....	
94,675	700	.0147	.....	
101,438	750	.0161	.....	
108,200	800	.0175	.....	
114,963	850	.0189	.....	
121,725	900	.0203	.....	
128,488	950	.0217	.....	
135,250	1,000	.0231	.0030	E (600–1,000) = 2,020,000 pounds per square inch.
.....	600	.0138	.0030	
.....	600	.0139	.0030	
148,775	1,100	.0260	.....	
162,300	1,200	.0289	.....	
175,825	1,300	.0315	.....	
189,350	1,400	.0340	.....	
202,875	1,500	.0370	.0045	
.....	600	.0165	.045	
.....	600	.0164	.0044	
216,400	1,600	.0402	.....	
229,925	1,700	.0431	.....	
243,450	1,800	.0461	.....	
256,975	1,900	.0493	.....	
270,500	2,000	.0525	.0064	E (1,000–2,000) = 1,923,000 pounds per square inch.
.....	600	.0193	.0063	
.....	600	.0193	.0063	
284,025	2,100	.0564	.....	
297,550	2,200	.0589	.....	
311,075	2,300	.0620	.....	
324,600	2,400	.0650	.....	

No. 1824—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
338,125	2,050	.0685	.0088	
.....	600	.0227	.0087	
.....	600	.0227	.0087	
351,650	2,600	.0731	.....	
365,175	2,700	.0766	.....	
378,700	2,800	.0796	.....	
392,225	2,900	.0832	.....	
405,750	3,000	.0866	.0120	E(2,000-3,000)=1,754,000 pounds per square inch.
.....	600	.0273	.0118	
.....	600	.0271	.0017	
443,800	3,281	.....	.....	Ultimate strength.

Pier failed along middle of its height. Opened longitudinal cracks, partially crushing the brick in several of the courses.

No. 1825.

11".5 SAND-STRUCK BRICK PIER.

Red, sand-struck brick, same as used in piers Nos. 1823 and 1824.
Material received from The Stiles & Hart Co., North Haven, Conn.
Built of 38 courses of brick, with solid core. Joints broken every 6 courses; 4 sections have 6 courses, 2 have 7.
Laid in cement mortar—1 part Saylor's Portland cement and 1 part sand.
Age, 3 months 10 days.
Weight, 970 pounds = 127.8 pounds per cubic foot.
Height of pier, 96.50 inches.
Sectional area, 11".64 × 11".67 = 135.84 square inches.
Average thickness of joints, ".26.
Gauged length, 50".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
13,584	100	0.	0.	Initial load. Loaded with 12,000 pounds before testing.
20,376	150	.0010	.0001	
27,168	200	.0023	.0004	
33,960	250	.0036	.0006	
40,752	300	.0047	.0008	
47,544	350	.0060	.0009	
54,336	400	.0073	.0010	
61,128	450	.0085	.0012	
67,920	500	.0096	.0015	
74,712	550	.0110	.0016	
81,504	600	.0123	.0018	E (100-600) = 2,381,000 pounds per square inch.
....	600	.0123	.0018	
88,296	650	.0138	.....	
95,088	700	.0149	.....	
101,880	750	.0163	.....	
108,672	800	.0177	.....	
115,464	850	.0190	.....	
122,256	900	.0205	.....	
129,048	950	.0218	.....	
135,840	1,000	.0233	.0028	E (600-1,000) = 2,000,000 pounds per square inch.
.....	600	.0140	.0028	
.....	600	.0140	.0028	
149,424	1,100	.0260	.....	
163,008	1,200	.0285	.....	
176,592	1,300	.0310	.....	
190,176	1,400	.0336	.....	
203,760	1,500	.0366	.0040	Snapping sounds.
.....	600	.0161	.0040	
.....	600	.0160	.0040	
217,344	1,600	.0395	.....	
230,928	1,700	.0424	.....	
244,512	1,800	.0454	.....	
258,096	1,900	.0485	.....	
271,680	2,000	.0514	.0055	E (1,000-2,000) = 1,969,000 pounds per square inch.
.....	600	.0186	.0055	
.....	600	.0185	.0055	
285,264	2,100	.0550	.....	
298,848	2,200	.0577	.....	
312,432	2,300	.0605	.....	
326,016	2,400	.0635	.....	
339,600	2,500	.0673	.0079	
.....	600	.0220	.0078	
.....	600	.0218	.0078	

No. 1825—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
353,184	2,600	.0710	.....	
366,768	2,700	.0742	.....	
380,352	2,800	.0774	.....	
393,939	2,900	.0806	.....	
407,520	3,000	.0843	.0100	Ultimate strength. E (2,000-3,000)=1,761,000 pounds per square inch.
.....	600	.0253	.0098	
.....	600	.0251	.0098	

Pier failed upon reapplication of 400,000 pounds total load after observations under loads of 600 pounds per square inch were made. Opened longitudinal cracks along middle of height.

No. 1821.

12″ COMMON BRICK PIER.

Common red, sand-struck brick.

Materials received from I. L. Stiles & Son Brick Company, North Haven, Conn.

Built of 37 courses of brick, with solid core.

Laid in cement mortar—1 part Saylor's Portland cement and 1 part sand.

Age, 3 months.

Weight, 920 pounds = 112.6 pounds per cubic foot.

Height of pier, 96.40 inches.

Sectional area, 12″.09 × 12″.11 = 146.41 square inches.

Average thickness of joints, ″.36.

Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
14,641	100	0.	0.	Initial load. Loaded with 10,000 pounds before testing.
21,962	150	.0011	.0001	
29,282	200	.0023	.0003	
36,603	250	.0034	.0004	
43,923	300	.0047	.0006	
51,244	350	.0059	.0009	
58,564	400	.0071	.0009	
65,885	450	.0083	0010	
73,205	500	.0095	.0012	
80,526	550	.0107	.0013	
87,846	600	.0120	.0013	E (100–600) = 2,336,000 pounds per square inch.
.....	600	.0120	.0014	
95,167	650	.0132	.....	
102,487	700	.0144	.....	
109,808	750	.0156	.....	
117,128	800	.0170	.....	
124,449	850	.0183	.....	
131,769	900	.0196	.....	
139,090	950	.0208	.....	
146,410	1,000	.0222	.0023	E (600–1,000) = 2,174,000 pounds per square inch.
.....	600	.0128	.0021	
.....	600	.0130	.0021	
161,051	1,100	.0245	.....	
175,692	1,200	.0271	.....	
190,333	1,300	.0295	.....	
204,974	1,400	.0320	.....	Snapping sounds.
219,615	1,500	.0345	.0030	
.....	600	.0143	.0030	
.....	600	.0143	.0030	
234,256	1,600	.0373	.....	
248,897	1,700	.0400	.....	
263,538	1,800	.0430	.....	
278,179	1,900	.0458	.....	
292,820	2,000	.0485	.....	
			.0043	E (1,000–2,000) = 2,058,000 pounds per square inch.
.....	600	.0157	.0040	
.....	600	.0155	.0041	
307,461	2,100	.0520	.....	
322,102	2,200	.0540	.0048	
420,000	2,869	.....	.....	Ultimate strength.

Brick flaked off in course near middle of height of pier. Longitudinal cracks developed.

No. 1828.

12″ SAND-STRUCK BRICK PIER.

Sand-struck brick, same as used in pier No. 1821.

Material received from I. L. Stiles & Son Brick Company, North Haven, Conn.

Built of 37 courses of brick, with hollow core.

Laid in cement mortar—1 part Saylor's Portland cement and 1 part sand.

Age, 3 months 4 days.

Weight, 746 pounds = 113.4 pounds per cubic foot.

Height of pier, 95.85 inches.

Outside dimensions, 12″ × 12″.02 = 144.24 square inches.

Core, 5″.03 × 5″.08 = 25.55 square inches.

Net sectional area, 118.69 square inches.

Average thickness of joints, ″.38.

Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
11,869	100	0.	0.	Initial load. Loaded with 6,000 pounds before testing.
17,804	150	.0011	0.	
23,738	200	.0026	.0001	
29,673	250	.0040	.0004	
35,607	300	.0055	.0006	
41,542	350	.0070	.0007	
47,476	400	.0085	.0009	
53,411	450	.0100	.0010	
59,345	500	.0114	.0010	
65,280	550	.0130	.0012	
71,214	600	.0145	.0013	E (100-600) = 1,894,000 pounds per square inch.
.....	600	.0146	.0013	
77,149	650	.0161	.....	
83,083	700	.0178	.....	
89,018	750	.0194	.....	
94,952	800	.0210	.....	
100,889	850	.0224	.....	
106,821	900	.0242	.....	
112,756	950	.0258	.....	
118,690	1,000	.0273	.0021	E (600-1,000) = 1,667,000 pounds per square inch. Snapping sounds.
.....	600	.0159	.0021	
.....	600	.0160	.0021	
130,559	1,100	.0303	.....	
142,428	1,200	.0335	.....	
154,297	1,300	.0367	.....	
166,166	1,400	.0400	.....	
178,035	1,500	.0436	.0031	
.....	600	.0181	.0033	
.....	600	.0180	.0033	
189,904	1,600	.0474	.....	
201,773	1,700	.0508	.....	
213,642	1,800	.0543	.....	
225,511	1,900	.0578	.....	
237,380	2,000	.0610	.0048	E (1,000-2,000) = 1,613,000 pounds per square inch.
.....	600	.0206	.0046	
.....	600	.0206	.0046	
306,000	2,578	.....	.....	Ultimate strength.

Pier failed by opening longitudinal cracks, bricks in courses at middle of height crushing.

No. 1829.

12″ SAND-STRUCK BRICK PIER.

Sand-struck brick.

Material received from I. L. Stiles & Son Brick Company, North Haven, Conn.

Built of 38 courses of brick, with solid core. Joints broken every six courses.

Laid in lime mortar—1 part lime and 3 parts sand.

Age, 3 months 4 days.

Weight, 837 pounds = 104.1 pounds per cubic foot.

Height of pier, 96.60 inches.

Sectional area, 11″.94 × 12″.05 = 143.88 square inches.

Average thickness of joints, ″.28.

Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
14,388	100	0.	0.	Initial load. Loaded with 6,000 pounds before testing.
21,582	150	.0185	.0159	
28,776	200	.0460	.0399	Snapping sounds.
35,970	250	.0710	.0616	
43,164	300	.1000	.0870	
50,358	350	.1278	.1110	
57,552	400	.1652	.1457	
64,746	450	.1860	.1615	
71,940	500	.2275	.2010	
105,000	730	.....	.....	Ultimate strength.

Opened longitudinal cracks, which finally extended nearly the full height of the pier. These cracks began to develop during the early stages of the test, and were visible when the pier was loaded with 400 pounds per square inch. They increased rapidly in extent as the ultimate strength of the pier was reached.

No. 1760.

12″ PAVING BRICK PIER.

Paving bricks branded "Johnsonburg, Pa."
Built of 24 courses of brick, with hollow core. Bricks laid on edge.
Laid in neat Saylor's Portland cement.
Age, 4 days 18 hours.
Weight, 967 pounds = 143.7 pounds per cubic foot.
Height of pier, 97.95 inches.
Outside dimensions, 12″.76 × 12″.67 = 161.67 square inches.
Core, 6″.50 × 6″.60 = 42.90 square inches.
Net sectional area, 118.77 square inches.
Close end joints.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
11,877	100	0.	0.	Initial load. Loaded with 10,000 pounds before testing.
17,816	150	.0008	.0002	
23,754	200	.0015	.0005	
29,693	250	.0023	.0008	
35,631	300	.0030	.0009	
41,570	350	.0039	.0012	
47,508	400	.0046	.0014	
53,447	450	.0055	.0016	
59,385	500	.0064	.0018	
65,324	550	.0073	.0019	
71,262	600	.0082	.0020	E (100–600) = 4,032,000 pounds per square inch.
.....	600	.0081	.0020	
77,201	650	.0090	.0021	
83,139	700	.0098	.0023	
89,078	750	.0106	.0026	
95,016	800	.0116	.0028	
100,955	850	.0124	.0029	Test interrupted 30 minutes. Sudden lowering of temperature of room.
106,893	900	.0126	.0026	
112,832	950	.0137	.0028	
118,770	1,000	.0146	.0030	E (600–1,000) = 3,704,000 pounds per square inch.
.....	600	.0100	.0030	
.....	600	.0102	.0031	
130,647	1,100	.0164	.0035	
142,524	1,200	.0180	.0038	
154,401	1,300	.0198	.0041	
166,278	1,400	.0220	.0048	Snapping sound.
178,155	1,500	.0240	.0050	
.....	600	.0129	.0048	
.....	600	.0129	.0048	
190,032	1,600	.0258	.0055	
201,909	1,700	.0282	.0063	
213,786	1,800	.0310	.0075	
225,663	1,900	.0329	.0080	
237,540	2,000	.0350	.0086	E (1,000–2,000) = 3,381,000 pounds per square inch.
.....	600	.0178	.0088	
.....	600	.0177	.0087	
249,417	2,100	.0373	.0095	
261,294	2,200	.0394	.0103	
273,171	2,300	.0434	.0126	
285,048	2,400	.0457	.0135	
296,925	2,500	.0484	.0145	
.....	600	.0245	.0145	
.....	600	.0245	.0145	

No. 1760—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
.....	.....	.....	.....	Rested under 20,000 pounds 16 hours.
.....	100	.....	.0148	
308,802	2,600	.0487	.0152	
320,679	2,700	.0508	.0157	
332,556	2,800	.0528	.0160	
344,433	2,900	.0547	.0163	
356,310	3,000	.0569	.0171	E (2,000-3,000)=3,731,000 pounds per square inch.
.....	600	.0276	.0171	
.....	600	.0273	.0171	
368,187	3,100	.0593	.0180	
380,064	3,200	.0620	.0188	Crack in course near middle of height of pier.
391,941	3,300	.0646	.0200	
403,818	3,400	.0679	.0213	
415,695	3,500	.0758	.0270	
.....	600	.0388	.0270	
.....	600	.0387	.0270	
501,000	4,218	.....	.....	Ultimate strength.

Opened longitudinal cracks.

No. 1761.

12" PAVING BRICK PIER.

Paving bricks branded "Johnsonburg, Pa."
Pier built of the lighter colored bricks of this lot.
Built of 24 courses of brick, with hollow core. Bricks laid on edge.
Laid in neat Saylor's Portland cement.
Age, 7 days.
Weight, 973 pounds = 144.8 pounds per cubic foot.
Height of pier, 97 inches.
Outside dimensions, $12''.75 \times 12''.80 = 163.20$ square inches.
Core, $6''.50 \times 6''.70 = 43.55$ square inches.
Net sectional area, 119.65 square inches.
Close end joints.
Gauged length, 50".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
11,965	100	0.	0.	Initial load. Loaded with 8,000 pounds before testing.
17,948	150	.0008	.0003	
23,930	200	.0015	.0005	
29,913	250	.0022	.0007	
35,895	300	.0028	.0008	
41,878	350	.0035	.0008	
47,860	400	.0042	.0009	
53,843	450	.0049	.0010	
59,825	500	.0055	.0011	
65,808	550	.0063	.0012	
71,790	600	.0072	.0013	E (100–600) = 4,237,000 pounds per square inch.
.....	600	.0071	.0013	
77,773	650	.0078	.0015	
83,755	700	.0085	.0018	
89,738	750	.0092	.0019	
95,720	800	.0099	.0020	
101,703	850	.0106	.0020	
107,685	900	.0114	.0021	
113,668	950	.0123	.0023	
119,650	1,000	.0129	.0025	E (600–1,000) = 4,444,000 pounds per square inch.
.....	600	.0086	.0025	
.....	600	.0085	.0025	
131,615	1,100	.0143	.0026	
143,580	1,200	.0158	.0028	
155,545	1,300	.0172	.0030	
167,510	1,400	.0187	.0032	
179,475	1,500	.0201	.0034	
.....	600	.0101	.0035	
.....	600	.0100	.0033	
191,440	1,600	.0217	.0037	
203,405	1,700	.0234	.0038	
215,370	1,800	.0248	.0040	
227,335	1,900	.0264	.0042	
239,300	2,000	.0280	.0045	E (1,000–2,000) = 3,817,000 pounds per square inch.
.....	600	.0120	.0045	
.....	600	.0120	.0045	
251,265	2,100	.0294	.0047	
263,230	2,200	.0310	.0048	
275,195	2,300	.0327	.0050	
287,160	2,400	.0344	.0054	
299,125	2,500	.0361	.0058	Snapping sounds. Rested under initial load 30 minutes.
.....	600	.0143	.0058	
.....	600	.0138	.0056	

No. 1761—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
311,090	2,600	.0378	.0059	
323,055	2,700	.0395	.0062	
335,020	2,800	.0411	.0066	
346,985	2,900	.0428	.0070	
358,950	3,000	.0446	.0072	E (2,000–3,000)=3,597,000 pounds per square inch.
.....	600	.0165	.0074	
.....	600	.0165	.0074	
370,915	3,100	.0472	.0081	
382,880	3,200	.0489	.0084	
394,845	3,300	.0504	.0088	
406,810	3,400	.0522	.0090	
418,775	3,500	.0542	.0095	
.....	600	.0197	.0095	
.....	600	.0196	.0095	
430,740	3,600	.0560	.0098	
442,705	3,700	.0578	.0101	
454,670	3,800	.0596	.0104	Crack in ninth course from upper end of pier.
.....	600	.0210	.0104	
.....	600	.0210	.0104	
466,635	3,900	.0611	.0111	
478,600	4,000	.0632	.0109	E (3,000–4,000)=3,356,000 pounds per square inch.
.....	600	.0221	.0109	
.....	600	.0220	.0110	
671,000	5,608	.....	.....	Ultimate strength.

Pier burst suddenly into fragments when the maximum load was reached. The fragments consisted of half-bricks and smaller pieces.

No. 1767.

12″ PAVING BRICK PIER.

Paving bricks branded "Johnsonburg, Pa."
Pier built of the darkest colored bricks of this lot.
Built of 24 courses of brick, with hollow core. Bricks laid on edge.
Laid in neat Saylor's Portland cement.
Age, 1 month 8 days.
Weight, 976 pounds = 145.2 pounds per cubic foot.
Height of pier, 98.25 inches.
Outside dimensions, 12″.76 × 12″.73 = 162.43 square inches.
Core, 6″.60 × 6″.70 = 44.22 square inches.
Net sectional area, 118.21 square inches.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
11,821	100	0.	0.	Initial load. Loaded with 6,000 pounds before testing.
17,732	150	.0009	.0002	
23,642	200	.0016	.0003	
29,553	250	.0024	.0004	
35,463	300	.0031	.0005	
41,374	350	.0038	.0006	
47,284	400	.0046	.0007	
53,195	450	.0054	.0008	
59,105	500	.0062	.0009	
65,016	550	.0068	.0010	
70,926	600	.0075	.0011	E (100-600) = 3,906,000 pounds per square inch.
.....	600	.0076	.0011	
76,837	650	.0083	.0012	
82,747	700	.0089	.0013	
88,658	750	.0096	.0014	
94,568	800	.0105	.0015	
100,479	850	.0113	.0015	
106,389	900	.0120	.0015	
112,300	950	.0127	.0016	
118,210	1,000	.0135	.0018	E (600-1,000) = 3,774,000 pounds per square inch.
.....	600	.0090	.0018	
.....	600	.0090	.0018	
130,031	1,100	.0150	.0019	
141,852	1,200	.0164	.0019	
153,673	1,300	.0180	.0021	
165,494	1,400	.0195	.0023	Snapping sound.
177,315	1,500	.0211	.0024	
.....	600	.0104	.0025	
.....	600	.0103	.0024	
189,136	1,600	.0229	.....	
200,957	1,700	.0243	.....	
212,778	1,800	.0259	.....	
224,599	1,900	.0276	.....	
236,420	2,000	.0290	.0033	E (1,000-2,000) = 3,571,000 pounds per square inch.
.....	600	.0120	.0034	
.....	600	.0120	.0034	
248,241	2,100	.0312	.....	
260,062	2,200	.0326	.....	
271,883	2,300	.0343	.....	
283,704	2,400	.0360	.....	
295,525	2,500	.0374	.0040	
.....	600	.0134	.0040	
.....	600	.0134	.0040	
307,346	2,600	.0402	.....	

No. 1767—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
319,167	2,700	.0419	.....	
330,988	2,800	.0437	.....	
342,809	2,900	.0450	.....	Crack in eleventh course.
354,630	3,000	.0475	.0060	E (2,000-3,000)=3,165,000 pounds per square inch.
.....	600	.0165	.0060	
.....	600	.0165	.0060	
.....	.....	.....	.0053	After resting under initial load 1 hour.
366,451	3,100	.0497	.....	
378,272	3,200	.0515	.....	
390,093	3,300	.0532	.....	
401,914	3,400	.0548	.....	
413,735	3,500	.0564	.0069	
.....	600	.0181	.0069	
.....	600	.0181	.0069	
425,556	3,600	.0606	.....	
506,000	4,281	.....	.....	Ultimate strength.

Longitudinal cracks developed, separating the bricks into halves and smaller fragments. The bed joints on the inside of the pier were not filled completely.

No. 1768.

12″ PAVING BRICK PIER.

Paving bricks branded "Johnsonburg, Pa."
Pier built of lighter colored brick than No. 1767.
Built of 24 courses of brick, with hollow core. Bricks laid on edge.
Laid in neat Saylor's Portland cement.
Age, 1 month 8 days.
Weight, 971 pounds = 143.6 pounds per cubic foot.
Height of pier, 97.75 inches.
Outside dimensions, 12″.70 × 12″.84 = 163.07 square inches.
Core, 6″.50 × 6″.70 = 43.55 square inches.
Net sectional area, 119.52 square inches.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
11,952	100	0.	0.	Initial load. Loaded with 8,000 pounds before testing.
17,928	150	.0004	.....	
23,904	200	.0010	.....	
29,880	250	.0014	.....	
35,856	300	.0020	.....	
41,832	350	.0025	.....	
47,808	400	.0030	.....	
53,784	450	.0037	.....	
59,760	500	.0042	.....	
65,736	550	.0049	.....	
71,712	600	.0056	.0008	E (100-600) = 5,208,000 pounds per square inch.
77,688	650	.0062	.....	
83,664	700	.0067	.....	
89,640	750	.0073	.....	
95,616	800	.0079	.....	
101,592	850	.0084	.....	
107,568	900	.0090	.....	
113,544	950	.0097	.....	
119,520	1,000	.0102	.0015	E (600-1,000) = 5,128,000 pounds per square inch.
.....	600	.0063	.0014	
131,472	1,100	.0118	.....	
143,424	1,200	.0129	.....	
155,376	1,300	.0141	.....	
167,328	1,400	.0153	.....	
179,280	1,500	.0165	.0021	
.....	600	.0073	.0020	
191,232	1,600	.0180	.....	
203,184	1,700	.0193	.....	
215,136	1,800	.0204	.....	
227,088	1,900	.0217	.....	
239,040	2,000	.0230	.0024	E (1,000-2,000) = 4,202,000 pounds per square inch.
.....	600	.0083	.0025	
250,992	2,100	.0245	.....	
262,944	2,200	.0257	.....	
274,896	2,300	.0269	.....	
286,848	2,400	.0281	.....	
298,800	2,500	.0293	.0029	
.....	600	.0091	.0028	
310,752	2,600	.0309	.....	
322,704	2,700	.0320	.....	
334,656	2,800	.0333	.....	
346,608	2,900	.0345	.....	Crack in fourth course.
358,560	3,000	.0357	.0034	E (2,000-3,000) = 4,274,000 pounds per square inch.
.....	600	.0101	.0034	

No. 1768—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
370,512	3,100	.0368	.....	
382,464	3,200	.0379	.....	
394,416	3,300	.0390	.....	
406,368	3,400	.0404	.....	
418,320	3,500	.0418	.0034	
.....	600	.0106	.0034	
430,272	3,600	.0435	.....	
442,224	3,700	.0449	.....	
454,176	3,800	.0463	.....	
466,128	3,900	.0475	.....	
478,080	4,000	.0489	.0041	E (3,000–4,000)=4,000,000 pounds per square inch.
.....	600	.0119	.0041	
490,032	4,100	.0510	.....	
501,984	4,200	.0526	.....	
513,936	4,300	.0543	.....	
525,888	4,400	.0557	.....	
537,840	4,500	.0570	.0060	
.....	600	.0140	.0060	
598,000	5,003	.....	.....	Ultimate strength.

Opened longitudinal cracks extending nearly from end to end of the pier.

BRICK PIER NO. 1759.

AFTER COMPLETION OF TEST

No. 1759.

12" PAVING BRICK PIER.

Paving bricks branded "Johnsonburg, Pa."
Built of 23 courses of brick, with hollow core. Bricks laid on edge.
Laid in cement mortar—1 part Saylor's Portland cement and 2 parts sand.
Age, 44 hours.
Weight, 961 pounds = 146.7 pounds per cubic foot.
Height of pier, 96.50 inches.
Outside dimensions, 12".75 × 12".80 = 163.20 square inches.
Core, 6".7 × 6".85 = 45.90 square inches.
Net sectional area, 117.30 square inches.
Wide end joints.
Gauged length, 50".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
11,730	100	0.	0.	Initial load. Loaded with 7,000 pounds before testing.
17,595	150	.0028	.0021	
23,460	200	.0067	.0049	
29,325	250	.0108	.0085	
35,190	300	.0168	.0130	
41,055	350	.0211	.0174	
46,920	400	.0265	.0212	
52,785	450	.0320	.0252	
58,650	500	.0377	.0300	
64,515	550	.0421	.0337	
70,380	600	.0491	.0390	E (100-600) = 2,475,000 pounds per square inch.
.....	600	.0514	.0410	
76,245	650	.0548	.0436	
82,110	700	.0593	.0472	
87,975	750	.0645	.0514	
93,840	800	.0695	.0553	
99,705	850	.0742	.0588	
105,570	900	.0795	.0630	
111,435	950	.0847	.0670	
117,300	1,000	.0896	.0710	E (600-1,000) = 2,353,000 pounds per square inch.
.....	600	.0832	.0714	
.....	600	.0831	.0717	
129,030	1,100	.0965	.0763	
140,760	1,200	.1051	.0825	
152,490	1,300	.1126	.0883	Snapping sound.
164,220	1,400	.1229	.0962	Crack in seventh course from bottom.
.....	600	.1159	.1024	
.....	600	.1160	.1025	
187,680	1,600	.1380	.1076	
199,410	1,700	.1450	.1125	
211,140	1,800	.1526	.1181	
222,870	1,900	.1620	.1256	
234,600	2,000	.1740	.1350	E (1,000-2,000) = 2,451,000 pounds per square inch.
.....	600	.1501	.1352	
.....	600	.1501	.1357	
.....	200	.1396	.....	
.....	400	.1454	.....	
.....	600	.1500	.....	
.....	800	.1543	.....	
.....	1,000	.1580	.....	

No. 1759—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
.....	800	.1554	.....	
.....	600	.1520	.....	
.....	400	.1479	.....	
.....	200	.1417	.1364	
287,000	2,447	.....	.....	Ultimate strength.

Cracks gradually developed after the first one appeared, as the loads were advanced. At the time the maximum load was reached there were two cracks which were continuous, reaching nearly from end to end of the pier. Shorter cracks opened generally, more numerous in the lower half of the pier.

No. 1762.

12″ PAVING BRICK PIER.

Paving bricks branded "Shawmut, Pa."
Built of 24 courses of brick, with hollow core. Bricks laid on edge.
Laid in neat Saylor's Portland cement.
Age, 4 hours.
Weight, 883 pounds = 143.3 pounds per cubic foot.
Height of pier, 95.05 inches.
Outside dimensions, 12″.14 × 12″.17 = 147.74 square inches.
Core, 5″.95 × 6″ = 35.70 square inches.
Net sectional area, 112.04 square inches.
Close end joints.
Gauged length, 50″.

This pier was laid up during the forenoon and tested during the afternoon of the same day. The time of reaching the maximum load was four hours after the last course of bricks was laid.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
11,204	100	0.	0.	Initial load. Loaded with 10,000 pounds before testing.
16,806	150	.0049	.0031	
22,408	200	.0121	.0086	
28,010	250	.0197	.0133	
33,612	300	.0264	.0176	
39,214	350	.0320	.0215	
44,816	400	.0389	.0259	Snapping sounds.
50,418	450	.0435	.0290	Cracks in first and third courses from upper end of pier.
56,020	500	.0483	.0319	
61,622	550	.0544	.0368	
67,224	600	.0608	.0412	E (100-600) = 1,276,000 pounds per square inch.
.....	600	.0629	.0429	
72,826	650	.0665	.0452	
78,428	700	.0714	.0486	
84,030	750	.0763	.0520	
89,632	800	.0806	.0553	
95,234	850	.0845	.0578	
100,836	900	.0900	.0622	E (600-900) = 1,829,000 pounds per square inch.
236,000	2,106	.....	.....	Ultimate strength.

Pier failed by opening cracks along its height, separating the bricks into half-bricks and smaller fragments. A number of bricks crushed near the middle of the height of the pier on one of the vertical sides and at middle of this face, as the pier rested in the testing machine.

No. 1763.

12" PAVING BRICK PIER.

Paving bricks branded "Shawmut, Pa."
Built of 24 courses of brick, with hollow core. Bricks laid on edge.
Laid in neat Saylor's Portland cement.
Age, 2 days.
Weight, 883 pounds = 141.5 pounds per cubic foot.
Height of pier, 95.55 inches.
Outside dimensions, 12".20 × 12".22 = 149.08 square inches.
Core, 6" × 6".05 = 36.30 square inches.
Net sectional area, 112.78 square inches.
Close end joints.
Gauged length, 50".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
11,278	100	0.	0.	Initial load. Loaded with 8,000 pounds before testing.
16,917	150	.0007	0.	
22,556	200	.0018	.0004	
28,195	250	.0028	.0008	
33,834	300	.0036	.0009	
39,473	350	.0046	.0012	
45,112	400	.0056	.0017	
50,750	450	.0069	.0019	
56,390	500	.0080	.0022	
62,029	550	.0091	.0028	
67,668	600	.0103	.0030	E (100-600) = 3,425,000 pounds per square inch.
.....	600	.0105	.0031	
73,307	650	.0117	.0034	
78,946	700	.0128	.0040	
84,585	750	.0141	.0044	
90,224	800	.0153	.0049	
95,863	850	.0170	.0056	
101,502	900	.0182	.0061	
107,141	950	.0197	.0067	
112,780	1,000	.0213	.0074	E (600-1,000) = 3,030,000 pounds per square inch.
.....	600	.0161	.0075	
.....	600	.0161	.0075	
124,058	1,100	.0239	.0085	
135,336	1,200	.0273	.0100	
146,614	1,300	.0304	.0115	
157,892	1,400	.0340	.0134	Snapping sound.
169,170	1,500	.0371	.0147	
.....	600	.0246	.0146	
.....	600	.0245	.0146	
180,448	1,600	.0408	.0168	
191,726	1,700	.0450	.0189	
203,004	1,800	.0482	.0206	
214,282	1,900	.0525	.0229	Cracks in third, fourth, and fifth courses from bottom.
225,560	2,000	.0566	.0254	E (1,000-2,000) = 2,890,000 pounds per square inch.
.....	600	.0368	.0255	
.....	600	.0368	.0255	
236,838	2,100	.0600	.0270	
248,116	2,200	.0645	.0296	
259,394	2,300	.0693	.0328	
270,672	2,400	.0760	.0371	
281,950	2,500	.0813	.0407	
.....	600	.0539	.0408	
.....	600	.0535	.0406	

No. 1763—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
293,228	2,600	.0858	.0434	
304,506	2,700	.0921	.0479	
315,784	2,800	.0967	.0503	
327,062	2,900	.1010	.0529	
338,340	3,000	.1058	.0563	E (2,000-3,000)=2,732,000 pounds per square inch.
.....	600	.0710	.0563	
.....	600	.0710	.0563	
421,000	3,733	.....	.....	Ultimate strength.

Longitudinal cracks opened, extending nearly the height of the pier.

No. 1764.

12" PAVING BRICK PIER.

Paving bricks branded "Shawmut, Pa."
Built of 24 courses of brick, with hollow core. Bricks laid on edge.
Laid in neat Saylor's Portland cement.
Age, 7 days.
Weight, 907 pounds = 145.6 pounds per cubic foot.
Height of pier, 95.35 inches.
Outside dimensions, $12''.22 \times 12''.25 = 149.70$ square inches.
Core, $5''.97 \times 6''.15 = 36.72$ square inches.
Net sectional area, 112.98 square inches.
Close end joints.
Gauged length, 50".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
11,298	100	0.	0.	Initial load. Loaded with 8,000 pounds before testing.
16,947	150	.0006	0.	
22,596	200	.0011	.0002	
28,245	250	.0017	.0004	
33,894	300	.0023	.0005	
39,543	350	.0031	.0006	
45,192	400	.0038	.0008	
50,841	450	.0046	.0007	
56,490	500	.0053	.0009	
62,139	550	.0060	.0010	
67,788	600	.0068	.0011	E (100–600) = 4,386,000 pounds per square inch.
.....	600	.0068	.0011	
73,437	650	.0075	.0012	
79,086	700	.0083	.0013	
84,735	750	.0090	.0014	
90,384	800	.0098	.0015	
96,033	850	.0105	.0016	
101,682	900	.0114	.0017	
107,331	950	.0123	.0018	
112,980	1,000	.0131	.0020	E (600–1,000) = 3,704,000 pounds per square inch.
.....	600	.0084	.0020	
.....	600	.0084	.0019	
124,278	1,100	.0146	.0021	
135,576	1,200	.0161	.0024	
146,874	1,300	.0179	.0026	
158,172	1,400	.0194	.0028	
169,470	1,500	.0214	.0031	Snapping sound.
.....	600	.0107	.0033	
.....	600	.0107	.0032	
180,768	1,600	.0234	.0035	
192,066	1,700	.0250	.0039	
203,364	1,800	.0269	.0041	
214,662	1,900	.0289	.0045	
225,960	2,000	.0308	.0048	E (1,000–2,000) = 3,356,000 pounds per square inch.
.....	600	.0135	.0049	
.....	600	.0135	.0048	
237,258	2,100	.0325	.0050	
248,556	2,200	.0344	.0051	
259,854	2,300	.0365	.0055	Cracks in bricks in third course from bottom and sixth course from top.
271,152	2,400	.0387	.0063	
282,450	2,500	.0406	.0066	
.....	600	.0167	.0066	
.....	600	.0167	.0066	

No. 1764—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
293,748	2,600	.0428	.0072	Cracks in fourth course from bottom. Set of ".0064 after resting 30 minutes.
305,046	2,700	.0430	.0071	
316,344	2,800	.0464	.0077	
327,642	2,900	.0486	.0082	
338,940	3,000	.0513	.0093	E (2,000-3,000)=3,125,000 pounds per square inch.
.....	600	.0207	.0093	
.....	600	.0207	.0093	
350,238	3,100	.0536	.0098	
361,536	3,200	.0562	.0106	
372,834	3,300	.0585	.0113	
384,134	3,400	.0609	.0121	
395,430	3,500	.0635	.0134	
.....	600	.0257	.0134	
.....	600	.0257	.0134	
510,000	4,514	.....	.....	Ultimate strength.

Opened longitudinal cracks, separating the bricks into halves and smaller fragments, over a part of the height of the pier.

No. 1780.

12″ PAVING BRICK PIER.

Paving bricks branded "Shawmut, Pa."

Pier built of 25 courses of brick, with hollow core. Bricks laid on edge.

Laid in neat Saylor's Portland cement.

Age, 4 months 7 days.

Weight, 910 pounds = 143.1 pounds per cubic foot.

Height of pier, 99.15 inches.

Outside dimensions, 12″.16 × 12″.17 = 147.99 square inches.

Core, 6″ × 6″.2 = 37.2 square inches.

Net sectional area, 110.79 square inches.

Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
11,079	100	0.	0.	Initial load. Loaded with 14,000 pounds before testing.
16,619	150	.0005	0.	
22,158	200	.0012	0.	
27,698	250	.0019	.0001	
33,237	300	.0025	.0003	
38,777	350	.0030	.0005	
44,316	400	.0038	.0006	
49,856	450	.0045	.0007	
55,395	500	.0052	.0008	
60,935	550	.0057	.0009	
66,474	600	.0064	.0011	E (100-600) = 4,717,000 pounds per square inch.
.....	600	.0066	.0011	
72,014	650	.0073	.0012	
77,553	700	.0079	.0013	
83,093	750	.0086	.0013	
88,632	800	.0092	.0014	
94,172	850	.0099	.0015	
99,711	900	.0105	.0015	
105,251	950	.0111	.0016	
110,790	1,000	.0118	.0016	E (600-1,000) = 4,082,000 pounds per square inch.
.....	600	.0077	.0017	
.....	600	.0077	.0017	
121,869	1,100	.0130	.0018	
132,948	1,200	.0146	.0020	
144,027	1,300	.0160	.0021	
155,106	1,400	.0175	.0023	
166,185	1,500	.0191	.0026	Snapping sound.
.....	600	.0093	.0026	
.....	600	.0093	.0026	
177,264	1,600	.0205	.0027	
188,343	1,700	.0223	.0030	
199,422	1,800	.0238	.0032	
210,501	1,900	.0253	.0033	
221,580	2,000	.0267	.0035	E (1,000-2,000) = 3,846,000 pounds per square inch.
.....	600	.0108	.0035	
.....	600	.0107	.0034	
232,659	2,100	.0280	.0034	
243,738	2,200	.0296	.0038	
254,817	2,300	.0313	.0039	
265,896	2,400	.0326	.0040	
276,975	2,500	.0342	.0041	Cracks in one brick each in fifth and sixth courses from lower end of pier.
.....	600	.0123	.0043	
.....	600	.0124	.0043	

No. 1780—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
288,054	2,600	.0356	.0044	
299,133	2,700	.0372	.0045	
310,212	2,800	.0388	.0046	
321,291	2,900	.0404	.0048	
332,370	3,000	.0425	.0050	E (2,000-3,000)=3,497,000 pounds per square inch.
.....	600	.0142	.0052	
.....	600	.0142	.0052	
.....	600	.0142	.....	
.....	1,000	.0197	.....	
.....	1,500	.0259	.....	
.....	2,000	.0316	.....	
.....	1,500	.0264	.....	
.....	1,000	.0202	.....	
.....	600	.0149	.0054	
343,449	3,100	.0440	.....	
354,528	3,200	.0455	.....	
365,607	3,300	.0469	.....	
376,686	3,400	.0481	.....	
387,765	3,500	.0502	.0060	
.....	600	.0153	.0060	
.....	600	.0153	.0060	
453,000	4,089	.....	.....	Ultimate strength.

Opened longitudinal cracks in lower half of pier.

No. 1766.

12″ PAVING BRICK PIER.

Paving bricks, branded "Shawmut, Pa."
Built of 24 courses of brick, with hollow core. Bricks laid on edge.
Laid in cement mortar—1 part Saylor's Portland cement and 2 parts sand.
Age, 7 days.
Weight, 919 pounds = 145.4 pounds per cubic foot.
Height of pier, 97.75 inches.
Outside dimensions, 12″.25 × 12″.28 = 150.43 square inches.
Core, 6″.20 × 6″.25 = 38.75 square inches.
Net sectional area, 111.68 square inches.
Close end joints.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
11,168	100	0.	0.	Initial load. Loaded with 7,000 pounds before testing.
16,752	150	.0007	.0002	
22,336	200	.0013	.0003	
27,920	250	.0018	.0004	
33,504	300	.0023	.0005	
39,088	350	.0030	.0006	
44,672	400	.0036	.0006	
50,256	450	.0044	.0008	
55,840	500	.0051	.0009	
61,424	550	.0059	.0011	
67,008	600	.0068	.0012	E (100-600) = 4,464,000 pounds per square inch.
.....	600	.0068	.0013	
72,592	650	.0077	.0014	
78,176	700	.0086	.0016	
83,760	750	.0094	.0019	
89,344	800	.0106	.0020	
94,928	850	.0116	.0023	
100,512	900	.0128	.0026	
106,096	950	.0140	.0030	
111,680	1,000	.0152	.0034	E (600-1,000) = 3,226,000 pounds per square inch.
.....	600	.0101	.0034	
.....	600	.0101	.0034	
122,848	1,100	.0178	.0040	
134,016	1,200	.0207	.0051	
145,184	1,300	.0241	.0066	
156,352	1,400	.0277	.0083	
167,520	1,500	.0320	.0103	Snapping sound.
.....	600	.0184	.0099	
.....	600	.0183	.0098	
.....	100	.....	.0089	Set after resting 40 minutes.
178,688	1,600	.0347	.0010	
189,856	1,700	.0398	.0139	
201,024	1,800	.0448	.0166	
212,192	1,900	.0502	.0193	
223,360	2,000	.0556	.0228	E (1,000-2,000) = 2,381,000 pounds per square inch.
.....	600	.0335	.0229	
.....	600	.0335	.0229	
234,528	2,100	.0620	.0270	Cracks in fifth and seventh courses from bottom of pier.
245,696	2,200	.0692	.0318	
256,864	2,300	.0761	.0364	
268,032	2,400	.0822	.0402	
279,200	2,500	.0887	.0444	

No. 1766—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
.....	600	.0576	.0444	
.....	600	.0576	.0445	
290,368	2,600	.0964	.0498	
301,536	2,700	.1028	.0541	
312,704	2,800	.1103	.0593	
368,000	3,295	.....	.....	Ultimate strength.

Opened longitudinal cracks, and brick crushed in ninth course from lower end of pier.

No. 1781.

12″ SAND-LIME BRICK PIER.

Sand-lime bricks.
Pier built of 37 courses of brick, with hollow core.
Laid in cement mortar—1 part Alpha cement and 1 part sand.
Age, 1 year 8 months.
Weight, 845 pounds = 111.9 pounds per cubic foot.
Height of pier, 94.30 inches.
Outside dimensions, 12″.59 × 12″.60 = 158.63 square inches.
Core, 4″.5 × 4″.5 = 20.25 square inches.
Net sectional area, 138.38 square inches.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
13,838	100	0.	0.	Initial load. Loaded with 11,000 pounds before testing.
20,757	150	.0024	.0006	
27,676	200	.0048	.0006	
34,595	250	.0070	.0016	
41,514	300	.0095	.0021	
48,433	350	.0119	.0028	
55,352	400	.0143	.0033	
62,271	450	.0169	.0038	
69,190	500	.0198	.0044	
76,109	550	.0222	.0049	
83,028	600	.0246	.0053	E (100-600) = 1,295,000 pounds per square inch.
89,947	650	.0274	.0058	
96,866	700	.0302	.0065	
103,785	750	.0333	.0074	
110,704	800	.0362	.0080	
117,623	850	.0392	.0085	
124,542	900	.0423	.0093	
131,461	950	.0455	.0100	
138,380	1,000	.0489	.0109	E (600-1,000) = 1,070,000 pounds per square inch.
.....	600	.0339	.0110	
20,000	.....	.....	.....	Pier remained under this load 17 hours.
.....	100	.....	.0108	
.....	600	.0332	.0108	
152,218	1,100	.0577	.0137	
166,056	1,200	.....	.....	Ultimate strength.

Pier failed by crushing the brick and opening longitudinal cracks in the lower half. Rupture took place without previous signs of failure.

No. 1814.

12″ SAND-LIME BRICK PIER.

Sand-lime brick; material from the National Association of Manufacturers of Sand-Lime Products, Wilmington, Del.
Built of 38 courses of brick, with hollow core.
Laid in cement mortar—1 part Alpha cement and 1 part sand.
Age, 2 years.
Weight, 849 pounds = 111.6 pounds per cubic foot.
Height of pier, 96 inches.
Outside dimensions, 12″.53 × 12″.54 = 157.13 square inches.
Core, 4″.48 × 4″.48 = 20.07 square inches.
Net sectional area, 137.06 square inches.
Average thickness of joints, ″.25.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
13,706	100	0.	0.	Initial load. Loaded with 8,000 pounds before testing.
20,559	150	.0022	.0005	
27,412	200	.0045	.0009	
34,265	250	.0068	.0013	
41,118	300	.0090	.0019	
47,971	350	.0115	.0022	
54,824	400	.0139	.0025	
61,677	450	.0167	.0030	
68,530	500	.0192	.0035	
75,383	550	.0221	.0039	
82,236	600	.0248	.0042	E (100–600) = 1,214,000 pounds per square inch.
.....	600	.0251	.0044	
89,089	650	.0278	.....	
95,942	700	.0305	.....	
102,795	750	.0334	.....	
109,648	800	.0365	.....	
116,501	850	.0404	.....	
123,354	900	.0447	.....	
130,207	950	.0500	.....	
137,060	1,000	.0607	.0151	Ultimate strength. Brick in tenth course from top flaked off. E (600–1,000) = 800,000 pounds per square inch.
.....	600	.0430	.0151	
.....	600	.0431	.0153	
.....	.....	.....	.0145	After resting 2 hours.

Pier failed in the upper half. Bricks in the ninth, tenth, and eleventh courses from the top crushed, and longitudinal cracks opened in the vicinity. Upon reapplication of load after making observations under 600 pounds per square inch, the pier failed under a total load of 136,000 pounds.

TABULATION OF COMPRESSION TESTS OF BRICK PIERS.

Nominal dimensions, 12″ ×12″ by 8 feet high.
Piers laid in neat Portland cement, cement mortar, and lime mortar.
Saylor's Portland cement used.

No. of test.	Description of bricks.	Pier laid in—	Age.			Weight per cubic foot.	Net sectional area.	Compressive strength.		Modulus of elasticity between loads per square inch of—			Permanent set on gauged length of 50″ after loads in pounds per square inch of—		
								Total.	Per square inch.	100 and 600.	600 and 1,000.	1,000 and 2,000.	600.	1,000.	2,000.
			Mos.	*Days.*	*Hrs.*	*Pounds.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Inch.*	*Inch.*	*Inch.*
1815	Repressed red bricks	1 cement, 3 sand	24			128.7	125.92	274,000	2,176	1,453,000	1,352,000	1,213,000	.0019	.0033	.0055
1826	Wire-cut, redface bricks	1 cement, 1 sand	3	6		132.6	131.22	380,000	2,896	3,472,000	3,175,000	2,857,000	.0007	.0011	.0030
1827	do	do	3	6		131.9	132.71	392,000	2,954	3,571,000	2,985,000	2,874,000	.0021	.0032	.0062
1822	Wire-cut, face bricks	do	3	8		134.8	111.39	354,000	3,178	4,167,000	3,448,000	3,165,000	.0006	.0009	.0024
1782	Wire-cut, redface bricks	Neat cement	2			135.3	107.72	370,000	3,435	2,451,000	2,410,000	2,294,000	.0011	.0025	.0049
1820	Wire-cut, red bricks	1 cement, 1 sand	5	22		136.5	107.68	247,664	2,300	3,333,000	2,597,000	2,358,000	.0005	.0009	.0021
1816	do	1 cement, 2 sand	24			139.5	119.86	391,000	3,262	2,809,000	2,299,000	2,183,000	.0012	.0019	.0043
1817	Gray-face bricks	Neat cement	5	24		139.5	135.28	574,000	4,243	4,464,000	4,444,000	3,968,000	.0004	.0008	.0017
1818	do	1 cement, 1 sand	5	21		138.2	137.95	590,000	4,277	5,682,000	4,444,000	4,386,000	.0002	.0004	.0012
1819	do	do	5	21		141.9	78.47	277,600	3,538	5,435,000	4,651,000	3,906,000	.0010	.0016	.0033
1830	Light cream-colored face bricks.	do	2	16		134.9	134.60	433,000	3,217	6,410,000	5,405,000	4,960,000	.0002	.0004	.0011
1833	do	do	2	21		135.5	134.18	463,000	3,451	5,102,000	6,250,000	5,263,000	.0003	.0004	.0019
1832	do	do	2	21		138.4	78.65	363,500	4,622	6,579,000	6,061,000	5,435,000	.0002	.0007	.0024
1831	do	do	2	16		144.9	75.37	381,000	5,055	7,143,000	6,897,000	5,814,000	.0005	.0009	.0020
1823	Sand-struck bricks, red	do	3	10		128.6	135.14	464,000	3,433	2,688,000	2,222,000	2,183,000	.0009	.0015	.0032
1824	do	do	3	9		127.6	135.25	443,800	3,281	2,450,000	2,020,000	1,923,000	.0018	.0030	.0064
1825	do	do	3	10		127.8	135.84	407,520	3,000	2,381,000	2,000,000	1,969,000	.0018	.0028	.0055
1821	Common red, sand-struck bricks.	do	3			112.6	146.41	420,000	2,869	2,336,000	2,174,000	2,058,000	.0013	.0023	.0043
1828	do	do	3	4		113.4	118.69	306,000	2,578	1,894,000	1,667,000	1,613,000	.0013	.0021	.0048
1829	Sand-struck bricks	1 lime, 3 sand	3	4		104.1	143.88	105,000	730						
1760	Paving bricks, "Johnsonburg, Pa."	Neat cement		4	18	143.7	118.77	501,000	4,218	4,032,000	3,704,000	3,381,000	.0020	.0030	.0086
1761	do	do		7		144.8	119.65	671,000	5,608	4,237,000	4,444,000	3,817,000	.0013	.0025	.0045
1767	do	do	1	8		145.2	118.21	506,000	4,281	3,906,000	3,774,000	3,571,000	.0011	.0018	.0033
1768	do	do	1	8		143.6	119.52	598,000	5,003	5,208,000	5,128,000	4,202,000	.0008	.0015	.0024
1759	do	1 cement, 2 sand			44	146.7	117.30	287,000	2,447	2,475,000	2,353,000	2,451,000	.0390	.0710	.1350

1762	Paving bricks, "Shawmut, Pa."	Neat cement			4	143.3	112.04	236,000	2,106	1,276,000			.0412		
1763	do	do		2		141.5	112.78	421,000	3,733	3,425,000	3,030,000	2,890,000	.0030	.0074	.0254
1764	do	do		7		145.6	112.98	510,000	4,514	4,386,000	3,704,000	3,256,000	.0011	.0020	.0048
1780	do	do	4	7		143.1	110.79	453,000	4,089	4,717,000	4,082,000	3,846,000	.0011	.0016	.0035
1766	do	1 cement, 2 sand		7		145.4	111.68	368,000	3,295	4,464,000	3,226,000	2,381,000	.0012	.0034	.0228
1781	Sand-lime bricks	1 cement, 1 sand	20			111.9	138.38	166,056	1,200	1,295,000	1,070,000		.0053	.0109	
1814	do	do	24			111.6	137.06	137,060	1,000	1,214,000	800,000		.0042	.0151	

WOODEN POSTS.

WOODEN POSTS.

COMPRESSION TESTS OF SPECIMENS SENT TO THE JAMESTOWN EXPOSITION.

The Douglas fir, short-leaf and long-leaf pine sticks were tested on earlier occasions; they were redressed previous to the present tests. The white oak, spruce, and cypress were new sticks, not previously tested.

Name of wood.	Dimensions.			Sectional area.	Weight.	Loads applied.	
	Height.	Cross section.				Total.	Per square inch.
	Inches.	*Inches.*	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*	*Pounds.*
Douglas fir	96.00	9.68	11.47	111.03	207	550,000	4,955
Short-leaf pine	95.80	11.00	10.91	120.00	205	323,000	2,692
Long-leaf pine	95.80	11.03	11.26	124.20	266	576,000	4,638

Name of wood.	Dimensions.			Sectional area.	Weight.	Compressive strength.	
	Height.	Cross section.				Total.	Per square inch.
	Inches.	*Inches.*	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*	*Pounds.*
White oak	96.10	7.40	9.15	67.7	174	315,000	4,651
Spruce	86.14	9.02	9.15	82.5	113	297,000	3,600

White oak: This stick contained two large knots, $1\frac{1}{2}''$ and $2''$ diameter each, in the vicinity of which the wood crushed.

Spruce: This stick had 35 knots in it, ranging from $\frac{1}{2}''$ diameter to $1\frac{3}{4}''$ diameter. The grain was oblique and there were seasoning cracks present. Fracture occurred by splitting along the grain, opening the seasoning cracks wider.

No. 1783.

Wooden Post.

Cypress post.
Weight, 163 pounds = 29.2 pounds per cubic foot.
Average rate of growth, 9 to 26 rings per inch.
Height, 96.18 inches.
Sectional area, 10″ × 10″.05 = 100.5 square inches.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	S	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
10,050	100	0.	0.	Initial load.
15,075	150	.0019	0.	
20,100	200	.0039	0.	
25,125	250	.0060	0.	
30,150	300	.0080	0.	
35,175	350	.0102	0.	
40,200	400	.0122	.....	
45,225	450	.0145	.....	
50,250	500	.0170	.....	
55,275	550	.0194	.....	
60,300	600	.0218	0.	E (100-600) = 1,147,000 pounds per square inch.
.....	600	.0216	0.	
65,325	650	.0239	.....	
70,350	700	.0263	.....	
75,375	750	.0287	.....	
80,400	800	.0310	.....	
85,425	850	.0333	.....	
90,450	900	.0348	.....	
95,475	950	.0348	.....	
100,500	1,000	.0359	−.0006	E (600-1,000) = 1,361,000 pounds per square inch.
.....	600	.0208	−.0006	
.....	600	.0209	−.0006	
110,550	1,100	.0402	.....	
120,600	1,200	.0450	.....	
130,650	1,300	.0498	.....	
140,700	1,400	.0547	.....	
150,750	1,500	.0595	−.0004	
.....	600	.0213	−.0004	
.....	600	.0215	−.0003	
160,800	1,600	.0627	.....	
170,850	1,700	.0676	.....	
180,900	1,800	.0727	.....	
190,950	1,900	.0773	.....	
201,000	2,000	.0824	+.0005	E (1,000-2,000) = 1,101,000 pounds per square inch.
.....	600	.0222	.0004	
.....	600	.0221	.0003	
211,050	2,100	.0886	.....	
221,100	2,200	.0932	.....	
231,150	2,300	.0983	.....	
241,200	2,400	.1035	.....	
251,250	2,500	.1094	.0020	
.....	600	.0236	.0016	
.....	600	.0236	.0016	
261,300	2,600	.1152	.....	
271,350	2,700	.1219	.....	
281,400	2,800	.1295	.....	
291,450	2,900	.1395	.....	
301,500	3,000	.1506	.0093	E (2,000-3,000) = 842,000 pounds per square inch.
.....	600	.0319	.0090	
.....	600	.0317	.0089	
311,550	3,100	.1830	.0250	
320,500	3,189	.....	.....	Ultimate strength.

Fibers crushed 20″ from end of stick, the line of fracture taking an oblique course across the column. There was an incision, made possibly by a cant hook, near the corner of the stick, the line of fracture passing through this cut. The cut measured 1¼″ taken across the grain of the wood; depth not known.

RUBBER BELTING.

TENSILE TEST OF RUBBER BELTING.

Specimen branded: "Giant—Revere Rubber Company—Seamless and Stitched."
Length, 73″.30.
Width, 30″.10.
Thickness, ″.53.
Eight-ply.
Sectional area, 15.95 square inches.
Gauged length, 30″.

Total loads applied.	Elongation in gauged length.	Remarks.
Pounds.	*Inches.*	
500	.20	
1,000	.40	
1,500	.64	
2,000	.85	
2,500	1.00	
3,000	1.13	
3,500	1.30	
4,000	1.43	
4,500	1.60	
5,000	1.74	
6,000	1.98	
7,000	2.23	
8,000	2.46	
9,000	2.70	
10,000	2.85	
12,000	3.17	
14,000	3.47	
16,000	3.75	
18,000	4.00	
20,000	4.21	Width now 28″.75.
22,000	4.44	
24,000	4.63	
26,000	4.82	
28,000	5.05	
30,000	5.20	
61,400	.....	Tensile strength, total—3,850 pounds per square inch.

Parted 3½″ to 0″ from face of jaws.

STONE, MISCELLANEOUS.

COMPRESSIVE ELASTIC PROPERTIES OF STONE.

SANDSTONE.

SPECIMENS FROM MR. A. J. CAPRON, PORTLAND, OREG.

Samples from quarries of Tenino Sandstone Company, Tenino, Wash.

No. 1231.

Color, light green.
Total weight, 43.5 pounds = 134.7 pounds per cubic foot.
Length, 22″.85.
Sectional area, 4″.05 × 6″.04 = 24.46 square inches.
Gauged length, 10″.
Minute transverse cracks were visible in this specimen, across middle of length, at commencement of test.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,446	100	0.	0.	Initial load.
4,892	200	.0005	.....	
7,338	300	.0012	.....	
9,784	400	.0020	.....	
12,230	500	.0030	.0005	
14,676	600	.0036	.....	
19,568	800	.0052	.....	
24,460	1,000	.0070	.0012	
29,352	1,200	.0088	.....	
34,244	1,400	.0106	.0021	
39,136	1,600	.0125	.....	
44,028	1,800	.0140	.....	
48,920	2,000	.0158	.0033	E (1,000–2,000) = 1,493,000 pounds per square inch.
142,500	5,826	.....	.....	Ultimate strength.

Pyramidal fracture.

No. 1232.

Color, light green.
Total weight, 45.5 pounds = 138.3 pounds per cubic foot.
Length, 23″.27.
Sectional area, 4″.10 × 5″.95 = 24.40 square inches.
Gauged length, 10″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,440	100	0.	0.	Initial load.
4,880	200	.0006	.....	
7,320	300	.0010	.....	
9,760	400	.0013	.....	
12,200	500	.0018	.0002	
14,640	600	.0022	.....	
19,520	800	.0030	.0002	
24,400	1,000	.0041	.0004	
29,280	1,200	.0051	.0005	
34,160	1,400	.0061	.0007	
39,040	1,600	.0072	.....	
43,920	1,800	.0084	.....	
48,800	2,000	.0095	.0010	
53,680	2,200	.0108	.....	
58,560	2,400	.0119	.....	
63,440	2,600	.0132	.....	
68,320	2,800	.0144	.....	
73,200	3,000	.0155	.0021	
78,080	3,200	.0172	.....	
82,960	3,400	.0184	.....	
87,840	3,600	.0197	.....	
92,726	3,800	.0209	.....	
97,600	4,000	.0222	.0035	E (1,000–4,000) = 2,000,000 pounds per square inch.
.....	400	.0046	.....	
.....	800	.0065	.....	
.....	1,200	.0084	.....	
.....	1,600	.0105	.....	
.....	2,000	.0126	.....	
.....	2,400	.0145	.....	
.....	2,800	.0167	.....	
.....	3,200	.0186	.....	
.....	2,800	.0174	.....	
.....	2,400	.0159	.....	
.....	2,000	.0142	.....	
.....	1,600	.0124	.....	
.....	1,200	.0101	.....	
.....	800	.0083	.....	
.....	400	.0057	.0037	
102,480	4,200	.0237	.....	
107,360	4,400	.0250	.....	
112,240	4,600	.0264	.....	
117,120	4,800	.0278	.....	
122,000	5,000	.0293	.0052	
.....	.....	.....	.0049	After resting 2 minutes.
.....	400	.0062	.....	
.....	800	.0082	.....	
.....	1,200	.0102	.....	
.....	1,600	.0125	.....	
.....	2,000	.0147	.....	
.....	2,400	.0167	.....	
.....	2,800	.0188	.....	
.....	3,200	.0208	.....	
.....	2,800	.0196	.....	
.....	2,400	.0180	.....	
.....	2,000	.0165	.....	
.....	1,600	.0145	.....	
.....	1,200	.0126	.....	
.....	800	.0102	.....	
.....	400	.0077	.0052	
186,200	7,631	.....	.....	Ultimate strength.

Wedged-shaped fragments.

SPECIMENS FROM HERCULES SANDSTONE COMPANY, TENINO, WASH.

No. 1233.

Marks, "Hercules Stone."
Color, green.
Total weight, 67 pounds = 137.6 pounds per cubic foot.
Length, 33″.
Sectional area, 4″.27 × 5″.97 = 25.49 square inches.
Gauged length, 20″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,549	100	0.	0.	Initial load.
5,098	200	.0006	.....	
7,647	300	.0014	.....	
10,196	400	.0020	.....	
12,745	500	.0028	.0002	
15,294	600	.0038	.....	
17,843	700	.0048	.....	
20,392	800	.0055	.....	
22,941	900	.0066	.....	
25,490	1,000	.0075	.0008	
30,588	1,200	.0096	.....	
35,686	1,400	.0116	.....	
40,784	1,600	.0135	.....	
45,882	1,800	.0158	.....	
50,980	2,000	.0179	.0023	
56,078	2,200	.0202	.....	
61,176	2,400	.0224	.....	
66,274	2,600	.0246	.....	
71,372	2,800	.0268	.....	
76,470	3,000	.0289	.0040	
81,568	3,200	.0314	.....	
86,666	3,400	.0333	.....	
91,764	3,600	.0354	.....	
96,862	3,800	.0375	.....	
101,960	4,000	.0398	.0060	E (1,000–4,000) = 2,214,000 pounds per square inch.
.....	400	.0078	.....	
.....	800	.0113	.....	
.....	1,200	.0150	.....	
.....	1,600	.0186	.....	
.....	2,000	.0224	.....	
.....	2,400	.0263	.....	
.....	2,800	.0299	.....	
.....	3,200	.0333	.....	
.....	2,800	.0308	.....	
.....	2,400	.0279	.....	
.....	2,000	.0249	.....	
.....	1,600	.0215	.....	
.....	1,200	.0180	.....	
.....	800	.0140	.....	
.....	400	.0095	.0063	
203,920	8,000	.....	.....	Ultimate strength.

Opened longitudinal cracks, oblique to axis of specimen, following the grain of the stone; also transverse lines of fracture.

SPECIMENS FROM QUARRY OF THE HERCULES SANDSTONE COMPANY, TENINO, WASH.

COMPRESSION TESTS.

Compressed surfaces faced with plaster of Paris.
Tested on bed.

Dimensions.			Sectional area.	First crack.	Compressive strength.	
Height.	Compressed surfaces.				Total.	Per square inch.
Inches.	*Inches.*	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*	*Pounds.*
4.10	4.15	4.17	17.31	149,600	149,600	8,640
3.95	4.05	4.11	16.65	132,000	132,000	7,930
4.07	4.00	4.28	17.12	172,200	172,200	10,060

Pyramidal fractures.

CHEMICAL COMPOSITION.

Silica	66.25
Oxide of iron	4.13
Alumina	20.10
Lime	3.00
Magnesia	2.34
Oxide of sodium	1.31
Oxide of potash	0.17
Loss upon ignition	2.61

GRANITE.

COMPRESSION TESTS AND CHEMICAL ANALYSES.

Specimens received from the New England Granite Works, Westerly, R. I.

Description.	Chemical composition.						Compression tests.						
							Dimensions.			Sectional area.	First crack.	Compressive strength.	
	Silica.	Oxide of iron.	Alumina.	Lime.	Oxide of sodium.	Oxide of potash.	Height.	Compressed surfaces.				Total.	Per square inch.
							Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*
1 Red Westerly granite	67.80	3.40	18.70	2.18	4.55	2.91	2.00	1.98	2.00	3.96	106,000	113,000	28,540
2 White or pink Westerly granite	70.60	2.40	17.10	1.20	5.16	3.54	2.00	1.99	2.01	4.00	157,000	159,000	39,750
3 Old blue Westerly granite	67.90	3.51	18.80	2.15	4.51	2.95	2.00	2.00	2.00	4.00	76,000	97,100	24,275
4 Fine-grained Klondike granite	67.75	3.45	18.66	2.20	4.64	2.85	2.01	2.00	2.00	4.00	107,000	118,000	29,580
5 Concord, N. H., granite	70.20	2.26	17.74	1.15	5.15	3.52	2.01	2.01	1.98	3.98	86,000	94,200	23,670
Blue Westerly granite							2.01	2.01	2.02	4.06	129,800	129,800	31,970

Pyramidal fractures.

GRANITE.

COMPRESSION TESTS.

Material contributed by The Paris Mountain Granite Company, Greenville, S. C.
Samples finished on a rubbing bed.

	Dimensions.			Sectional area.	First crack.	Compressive strength.	
	Height.	Compressed surface.				Total.	Per square inch.
	Inches.	*Inches.*	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*	*Pounds.*
First cube	4.01	4.01	4.01	16.08	399,000	399,000	24,810
Second cube	4.01	4.01	4.01	16.08	376,000	376,000	23,380

CHEMICAL ANALYSIS OF SECOND CUBE.

Silica	68.50
Oxide of iron	9.86
Alumina	17.71
Lime	4.00
Magnesia	Trace.

SANDSTONE AND GRANITE.

COMPRESSION TESTS.

Material contributed by Mr. Albert J. Capron, Portland, Oreg.
Samples finished on a rubbing bed.

Description.	Dimensions.			Sectional area.	First crack.	Compressive strength.	
	Height.	Compressed surface.				Total.	Per square inch.
	Inches.	*Inches.*	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*	*Pounds.*
Sandstone	4.00	4.00	4.00	16.00	131,000	131,000	8,190
Granite	4.01	4.01	4.01	16.08	417,000	417,000	25,930
Do	4.00	4.00	4.00	16.00	390,000	409,000	25,560

172253—08——24

Tests of Material Collected at the Louisiana Purchase Exposition, St. Louis, Mo., 1904.

Specimens finished on a rubbing bed.

Marks.	Description.	Color.	Dimensions.			Sectional area.	First crack.	Compressive strength.	
			Height.	Compressed surface.				Total.	Per square inch.
			Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*
3*	Marble from Freidman, Ariz.	Light drab	4.00	4.00	4.00	16.00	506,000	[a] 800,000	50,000
3**	....do	Mottled; greenish drab with dark-red veins.	4.00	4.00	4.00	16.00	386,000	605,000	37,810
3***	....do	....do	4.00	4.00	4.00	16.00	280,000	538,000	33,625
3****	....do	Same as above, of lighter shades of colors.	3.50	3.50	3.49	12.22	218,000	339,000	27,760
34	Granite from Tishomingo, Ind. T.	Large pink crystals in dark-gray stone.	3.99	3.99	3.99	15.92	412,000	414,000	26,010
35	Marble from Marble City	Light gray	3.99	3.99	3.99	15.92	260,000	260,000	16,330
36*	Red sandstone from Chickasha, Chickasaw Nation	Light red	3.50	3.50	3.52	12.32	92,000	92,000	7,470
36**	....do	....do	3.50	3.50	3.51	12.29	97,600	97,600	7,940
37	Brown sandstone from Muscogee, Creek Nation	Light brown	4.00	4.00	3.97	15.88	133,000	135,000	8,500
38	Gray sandstone from South McAlester, Choctaw Nation	Light gray	4.02	3.99	4.02	16.04	168,000	168,000	10,470
39	Brown sandstone from Wagoner, Creek Nation	Light brown, yellowish	4.00	4.00	4.00	16.00	200,000	203,000	12,690
40	Red sandstone from Chelsea, Cherokee Nation	Light red	4.01	4.02	4.01	16.12	162,000	162,000	10,050
58	Sandstone from Silver City, N. Mex.	Brown	4.01	4.01	4.02	16.12	191,000	194,000	12,030

[a] Not ruptured.

LITHOGRAPHIC STONE.

SPECIMENS RECEIVED FROM THE UNITED STATES GEOLOGICAL SURVEY.

COMPRESSION TESTS.

Marks.	Dimensions.			Sectional area.	First crack.	Compressive strength.	
	Height.	Compressed surface.				Total.	Per square inch.
	Inches.	*Inches.*	*Inches.*	*Sq. Inches.*	*Pounds.*	*Pounds.*	*Pounds.*
No. 1	1.90	2.84	2.95	8.38	50,000	94,000	11,220
No. 2	1.60	2.85	3.00	8.55	31,000	75,800	8,870

BLUE-PRINT AND BROWN-PRINT PAPER.

BLUE-PRINT AND BROWN-PRINT PAPER.

TENSILE TESTS.

Specimens taken out 1″ wide by 5″ long over all.
Length between jaws of testing machine, 3″.

Furnished by—	Color.	Taken out.[a]	Thickness.	Sectional area.	Tensile strength.				
					Sample No.			Mean.	Per square inch.
					1.	2.	3.		
			Inch.	*Sq. in.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
1. Technical Supply Co.	Blue....	Crosswise....	.0053	.0053	18.25	18.75	17.25	18.1	3,420
Do.....	....do...	Lengthwise...	.0053	.0053	27.75	23.25	34.50	28.5	5,380
Do.....	Brown..	Crosswise....	.003	.003	18.00	23.00	25.25	22.1	7,370
Do.....	....do...	Lengthwise...	.003	.003	13.50	14.25	12.50	13.4	4,470
2. F. A. Schmidt...	Blue....	Crosswise....	.0053	.0053	8.25	9.75	12.25	10.1	1,910
Do.....	....do...	Lengthwise...	.0053	.0053	23.00	26.50	23.00	24.2	4,570
Do.....	Brown..	Crosswise....	.0045	.0045	13.00	11.75	12.25	12.3	2,730
Do.....	....do...	Lengthwise...	.0045	.0045	21.00	27.00	25.50	24.5	5,440
3. J. H. Weil & Co..	Blue....	Crosswise....	.0052	.0052	14.00	14.50	13.25	13.9	2,670
Do.....	....do...	Lengthwise...	.0052	.0052	27.50	27.50	26.00	27.0	5,190
Do.....	Brown..	Crosswise....	.003	.003	9.50	9.50	8.50	9.2	3,070
Do.....	....do...	Lengthwise...	.003	.003	15.75	18.25	13.00	15.7	5,230
4. Queen & Co.....	Blue....	Crosswise....	.0052	.0052	37.25	36.75	34.75	36.3	6,980
Do.....	....do...	Lengthwise...	.0052	.0052	22.75	21.50	21.75	22.0	4,230
Do.....	Brown..	Crosswise....	.0033	.0033	24.50	22.00	12.00	19.5	5,910
Do.....	....do...	Lengthwise...	.0033	.0033	15.75	17.00	15.00	15.9	4,820
5. Am. B. P. P. Co..	Blue....	Crosswise....	.005	.005	17.25	18.50	18.25	18.0	3,600
Do.....	....do...	Lengthwise...	.005	.005	29.50	32.00	29.75	30.4	6,080
Do.....	Brown..	Crosswise....	.0035	.0035	13.75	14.50	14.75	14.3	4,090
Do.....	....do...	Lengthwise...	.0035	.0035	25.50	27.00	29.75	27.4	7,830
6. Williams, Brown & Earl.	....do....	Crosswise....	.003	.003	13.00	13.25	13.00	13.1	4,370
Do.....	....do...	Lengthwise...	.003	.003	24.50	26.50	24.75	25.3	8,430
7. Keuffel & Esser..	Blue....	Crosswise....	.0042	.0042	17.75	19.75	19.50	19.0	4,520
Do.....	....do...	Lengthwise...	.0042	.0042	27.50	29.50	28.50	28.5	6,790

[a] "Lengthwise" and "Crosswise" signify the position of specimens as taken from samples received. The position of samples in rolls was not known.

Private Tests.

Tests made for private parties during the fiscal year ended June 30, 1907.

Date.	Material.	For whom tested.	
		Name.	City and State.
1906.			
July 3	Mortar cubes	Sanford E. Thompson	Newton Highlands, Mass.
26	Concrete building blocks	Town of South Framingham	South Framingham, Mass.
27	Steel specimens	Baldwin Steel Co	Cold Spring-on-Hudson, N. Y.
30	....do	The Wyman & Gordon Co	Worcester, Mass.
30	Wrought-iron tie rods	Old Colony Street Railway	Boston, Mass.
Aug. 3	Concrete	Boston Schoolhouse Board	Do.
3	Concrete building block.	M. Frank Eastman	Do.
14	Steel specimens	Savage Arms Co	Utica, N. Y.
21	Bronze specimens	New London Marine Iron Works	New London, Conn.
24	Bricks	New England Brick Co	Boston, Mass.
23	Shackles and swivel	The Fletcher & Crowell Co	Portland, Me.
23	Bricks	City of Boston	Boston, Mass.
27	Concrete building blocks.	The Davis Construction and Machinery Co.	Do.
27	Steel specimens	American and British Manufacturing Co.	Providence, R. I.
27	....do	Savage Arms Co	Utica, N. Y.
27	Cast iron and concrete	Town of South Framingham	South Framingham, Mass.
29	Manila rope	A. Leschen & Sons Rope Co.	St. Louis, Mo.
31	Concrete	Emerson & Norris Co.	Boston, Mass.
31	Terra cotta and bricks	George A. Fuller Co.	Do.
Sept. 6	Steel specimens	The Wyman & Gordon Co	Worcester, Mass.
8	....do	....do	Do.
12	Lally patent columns.	Lally Patent Column Co	Boston, Mass.
13	Cast iron	Golding Manufacturing Co	Franklin, Mass.
14	Bricks	George A. Fuller Co	Boston, Mass.
21	Steel specimens	Savage Arms Co	Utica, N. Y.
27	....do	The Wyman & Gordon Co	Worcester, Mass.
Oct. 2	Bricks	Plymouth Cordage Co	Plymouth, Mass.
4	Shackle	Boston and Lockport Block Co.	Boston, Mass.
5	Steel specimens	The Wyman & Gordon Co	Worcester, Mass.
5	....do	Savage Arms Co	Utica, N. Y.
6	Wrought iron	B. M. Jones & Co., Inc	Boston, Mass.
6	Cast iron	Golding Manufacturing Co	Franklin, Mass.
10	Wire-rope sockets, hooks and swivel.	The Thomas Laughlin Co	Portland, Me.
10	Steel specimens	The Wyman & Gordon Co	Worcester, Mass.
17	....do	....do	Do.
17	Wrought iron	American Diesel Engine Co	New York, N. Y.
18	Cotton duck	Hood Rubber Co	Boston, Mass.
19	Hoisting hooks	J. H. Williams Co	Brooklyn, N. Y.
23	Steel specimens	The Wyman & Gordon Co	Worcester, Mass.
25	Wrought iron	B. M. Jones & Co., Inc	Boston, Mass.
27	Steel specimens	Savage Arms Co	Utica, N. Y.
27	Concrete building blocks.	E. R. Taylor Co	Boston, Mass.
29	....do	Emerson & Norris Co	Do.
Nov. 1	Steel specimens	Savage Arms Co	Utica, N. Y.
9	Cotton duck	Hood Rubber Co	Boston, Mass.
17	Steel specimens	The Wyman & Gordon Co	Worcester, Mass.
17	....do	Savage Arms Co	Utica, N. Y.
19	....do	The Wyman & Gordon Co	Worcester, Mass.
19	Twisted steel bars	H. A. Carson	Boston, Mass.
21	Lally patent columns.	U. S. Column Co	Do.
21	Sulphur and cement	Merrimac Chemical Co	North Woburn, Mass.
21	Concrete building blocks.	J. A. Gibson	Buffalo, N. Y.
21	....do	J. L. Christensen	Do.
21	....do	George A. Siener	Do.
21	....do	E. J. Gillette	Do.
22	Steel specimens	The Wyman & Gordon Co	Worcester, Mass.
22	Manila rope	Standard Cordage Co	Boston, Mass.

Date.	Material.	For whom tested.	
		Name.	City and State.
1906.			
Dec. 1	Steel specimens	The Wyman & Gordon Co	Worcester, Mass.
3	Concrete building blocks.	The Davis Construction and Machinery Co.	Boston, Mass.
7	Steel specimens	Savage Arms Co	Utica, N. Y.
10	Concrete building blocks.	City of Buffalo	Buffalo, N. Y.
14	Old steel wire rope	The American Thread Co	Holyoke, Mass.
17	Steel specimens	The Wyman & Gordon Co	Worcester, Mass.
19	Steel bars	City of Cambridge	Cambridge, Mass.
21	Steel specimens	The Wyman & Gordon Co.	Worcester, Mass.
22	Wrought iron	E. D. Jones & Sons Co	Pittsfield, Mass.
22	Twisted steel bars	Boston Transit Commission	Boston, Mass.
22	Jack screws	do	Do.
1907.			
Jan. 7	Concrete building blocks.	J. L. Hooper & Son	Salem, Mass.
7	Wire rope	The American Thread Co	Holyoke, Mass.
8	Wrought iron	B. M. Jones & Co. Inc	Boston, Mass.
8	Steel specimens	The Wyman & Gordon Co	Worcester, Mass.
8	Malleable iron	Rhode Island Malleable Iron Works.	Hills Grove, R. I.
8	Bronze	Hood Rubber Co	Boston, Mass.
8	Cotton duck	do	Do.
9	Cotton cloth	American Rubber Co	East Cambridge, Mass.
10	Adhesion of steel bars in concrete.	Boston Transit Commission	Boston, Mass.
12	Steel specimens	Savage Arms Co	Utica, N. Y.
14	Concrete piles	Boston Elevated Railway Co	Boston, Mass.
14	Steel specimens	The Wyman & Gordon Co	Worcester, Mass.
15	Sand-lime bricks	Plymouth Cordage Co	Plymouth, Mass.
15	Concrete building blocks.	Buffalo Concrete Stone and Brick Co.	Buffalo, N. Y.
15	do	Marr Brothers	Quincy, Mass.
22	Manila rope	Standard Cordage Co	Boston, Mass.
23	Twisted steel bars	City of Cambridge	Cambridge, Mass.
26	Steel specimens	The Wyman & Gordon Co	Worcester, Mass.
26	Wrought iron	B. M. Jones & Co., Inc	Boston, Mass.
Feb. 1	do	do	Do.
5	Steel specimens	The Wyman & Gordon Co	Worcester, Mass.
8	Steel plate	Joseph H. McNeill	Boston, Mass.
9	Steel specimens	The Wyman & Gordon Co	Worcester, Mass.
16	do	do	Do.
18	Wrought iron	B. M. Jones & Co., Inc	Boston, Mass.
19	Shackles and swivels	The Fletcher & Crowell Co	Portland, Me.
20	Steel specimens	The Wyman & Gordon Co.	Worcester, Mass.
26	do	do	Do.
28	Cement bricks	R.M. Laidlaw	Boston, Mass.
Mar. 2	Cast iron	Farrel Foundry and Machine Co.	Ansonia, Conn.
2	do	The Edison Electric Illuminating Co. of Boston.	Boston, Mass.
7	Steel specimens	The Wyman & Gordon Co	Worcester, Mass.
8	do	do	Do.
12	do	The Baldwin Steel Co	New York, N. Y.
15	do	The Wyman & Gordon Co	Worcester, Mass.
16	do	do	Do.
18	do	do	Do.
20	Cement brick	Plymouth Cordage Co	Plymouth, Mass.
20	Steel bar	New England Bolt and Steel Co.	Boston, Mass.
21	Water hose	Revere Rubber Co	Chelsea, Mass.
23	Steel specimens	The Wyman & Gordon Co	Worcester, Mass.
26	Granite	Rockport Granite Co	Rockport, Mass.
28	Cast iron	B. F. Sturtevant Co	Hyde Park, Mass.
28	Steel specimens	Savage Arms Co	Utica, N. Y.
30	do	The Wyman & Gordon Co	Worcester, Mass.
30	Wrought iron	B. M. Jones & Co., Inc	Boston, Mass.
30	Twisted steel rods	City of Cambridge	Cambridge, Mass.
Apr. 2	Steel specimens	Savage Arms Co	Utica, N. Y.
2	Cast iron	B. F. Sturtevant Co	Hyde Park, Mass.
5	Concrete building blocks.	Chas. A. Drescher Co	Buffalo, N. Y.
6	Steel specimens	The Wyman & Gordon Co	Worcester, Mass.
8	Manila fibers	John S. Gillies	Manila, P. I.
9	Steel bar and rail	The Goldschmidt Thermit Co	New York, N. Y.
12	Steel specimens	A. H. Emery	Stamford, Conn.
13	do	do	Do.
13	Bronze	The William Cramp & Sons Ship and Engine Building Co.	Philadelphia, Pa.
13	Cast iron	The Davis & Farnum Manufacturing Co.	Waltham, Mass.

Date.		Material.	For whom tested.	
			Name.	City and State.
1907.				
Apr.	15	Steel specimens	The Wyman & Gordon Co	Worcester, Mass.
	15	do	Savage Arms Co	Utica, N. Y.
	18	Sand-lime bricks	Warren Brothers Co	East Cambridge, Mass.
	18	Concrete columns	Eastman Kodak Co	Rochester, N. Y.
	18	Cast iron	The Davis & Farnum Manufacturing Co.	Waltham, Mass.
	19	Steel specimens	Savage Arms Co	Utica, N. Y.
	19	Wrought iron	Laconia Car Co	Boston, Mass.
	19	do	B. M. Jones & Co., Inc	Do.
	20	Steel tubing	General Electric Co	West Lynn, Mass.
	24	Steel specimens	The Wyman & Gordon Co	Worcester, Mass.
	30	Cast iron	Golding & Co	Franklin, Mass.
May	1	Concrete building blocks.	Emerson & Norris Co	Boston, Mass.
	1	do	The Durolithic Co	Buffalo, N. Y.
	2	do	Chas. A. Drescher Co	Do.
	4	Steel specimens	The Wyman & Gordon Co	Worcester, Mass.
	4	do	Savage Arms Co	Utica, N. Y.
	8	Cast iron	The Davis & Farnum Manufacturing Co.	Waltham, Mass.
	8	Horse nails	Hoopeston Horse Nail Co	Bridgewater, Mass.
	13	Steel specimens	The Wyman & Gordon Co	Worcester, Mass.
	14	do	do	Do.
	14	Shackles	Fletcher & Crowell Co	Portland, Me.
	15	Wrought iron	B. M. Jones & Co., Inc	Boston, Mass.
	17	Cement cubes	Sanford E. Thompson	Newton Highlands, Mass.
	20	Cast iron	Farrel Foundry and Machine Co.	Ansonia, Conn.
	20	Harness leather	Pfister & Vogel Leather Co	New York, N. Y.
	20	Cast iron	The Davis & Farnum Manufacturing Co.	Waltham, Mass.
	25	Steel specimens	The Wyman & Gordon Co	Worcester, Mass.
	27	do	do	Do.
	27	Wrought iron	B. M. Jones & Co., Inc	Boston, Mass.
June	11	Steel specimens	The Wyman & Gordon Co	Worcester, Mass.
	11	Cast iron	The Davis & Farnum Manufacturing Co.	Waltham, Mass.
	12	Bronze	The New London Marine Iron Works.	New London, Conn.
	15	Cast iron	The Davis & Farnum Manufacturing Co.	Waltham, Mass.
	18	do	do	Do.
	24	Wrought iron	B. M. Jones & Co., Inc	Boston, Mass.
	24	Cast iron	Golding Manufacturing Co	Franklin, Mass.
	25	Shackles	Fletcher & Crowell Co	Portland, Me.
	26	Steel specimens	The Wyman & Gordon Co	Worcester, Mass.
	27	do	Savage Arms Co	Utica, N. Y.

INDEX.

	Page.
Amorphous steel, tensile tests	40
Analyses, chemical:	
Armor plate	42
Barrel steel	42
Base spring steel	42
Bayonet steel	42
Bayonet catch steel	42
Bolt steel	42
Butt plate steel	42
Cocking piece steel	42
Copper ingot	90
Cut-off sleeve steel	42
Eglentine metal	50
Ejector steel	42
Floor plate steel	42
Front sight stud steel	42
Granite, Westerly, R. I	367
Granite, Greenville, S. C	368
Guard steel	42
Knife for Hospital Corps, steel	42
Metallic fouling	90
Monel metal	60
Rear sight base steel	42
Receiver steel	42
Resista steel	40
Saber blade steel	42
Sandstone (Hercules), Washington	366
Sear and leaf steel	42
Sleeve steel	42
Upper band steel	42
Anchor bolt for gun carriage:	
Bending test	41
Tensile test	41
Belting, rubber, tensile test	359
Bits, steel, Monel metal and Eglentine metal	48, 49
Blue-print and brown-print paper, tensile tests	373
Brick piers:	
With hollow cores—	
Bricks laid flat; joints broken every course—	
Gray face	307–310
Re-pressed	297
Sand-lime	348, 349
Sand-struck	327
Wire-cut	300–306, 313, 314
Bricks laid flat; joints broken every six courses—	
Wire-cut	315
Bricks laid on edge; joints broken every course—	
Gray face	311, 312
Paving	329–347
Wire-cut	316, 317
Bricks laid on edge; joints broken every three courses—	
Wire-cut	318, 319

Brick piers—Continued. Page.
With solid cores—
Bricks laid flat; joints broken every course—
Sand-struck ... 320–323, 326
Wire-cut ... 298
Bricks laid flat; joints broken every six courses—
Sand-struck ... 324, 325, 328
Wire-cut ... 299
Tabulation ... 350, 351
Bricks:
Cement-sand brick—
Capron, A. J., absorption and compression tests ... 273
Face and building brick—
Capron, A. J., absorption and compression tests ... 274
Fredonia Brick Company, The, absorption and compression tests ... 269
New England Brick Company, compression tests ... 269
Fire brick—
Parker-Russell Mining and Manufacturing Company, The, compression tests ... 271
Partition block, hollow—
Bannon & Company, P., compression tests ... 272
Parker-Russell Mining and Manufacturing Company, The, compression tests ... 272
Paving brick—
Capron, A. J., absorption and compression tests ... 274
Fiske & Company, Incorporated, compression tests ... 270
Sand-lime brick—
Sandy Hook Proving Ground, absorption, compression and transverse tests ... 275, 276
West Point, quartermaster, U. S. Army, compression tests ... 274
Compressive elastic properties—
Canton Pressed Brick Company ... 280, 281
Coffeyville Vitrified Brick and Tile Company, The ... 278–280
Hydraulic-Press Brick Company ... 276–278
Jewettville Pressed and Paving Brick Company ... 282, 283
Laclede Fire Brick Manufacturing Company ... 290
Missouri, "Athens Block" ... 288
Missouri, "Malvern Blue Granite" ... 289
New Mexico ... 290
St. Louis Vitrified and Fire Brick Company ... 286, 287
Texarkana Brick Company ... 283, 284
Townsend Brick and Contracting Company, The T. B ... 285
Tuna Valley Pressed Brick Company ... 281, 282
Brown-print and blue-print paper, tensile tests ... 373
Cement:
Temperatures acquired by Portland cements while setting ... 129
Compression tests of 4-inch cubes of neat cement for long-time tests—
Austin ... 133
Bonneville Improved ... 133
Cathedral ... 133
Hoffman ... 133
Mankato ... 133
Newark & Rosendale ... 134
Potomac ... 134
Silica ... 133
Star, with plaster ... 133
Star, without plaster ... 133
Compression tests of 2-inch cubes of neat cement which set in air at different temperatures—
Alpha ... 135, 139
Atlas ... 135, 136
Austin ... 138, 140, 141
Newark & Rosendale ... 138, 139, 141
Star, with plaster ... 136, 137, 139, 140
Star, without plaster ... 137, 140
Whitehall ... 137, 140
Chains, counterweight, proof stresses ... 90

Page.
Comparison of testing machines, steel specimens for:
Tensile tests—
Bethlehem Steel Works 35–37
Frankford Arsenal 30–34
Watervliet Arsenal 24–29
Tabulation 38
Concrete and mortar columns, plain and reënforced:
Compressive elastic properties—
Plain, square columns, without reënforcement—
1 : 0 : 1 mixture (crusher dust) 145, 146
1 : 0 : 2 mixture (crusher dust) 147, 148
1 : 0 : 3 mixture (crusher dust) 149
1 : 0 : 4 mixture (crusher dust) 150, 151
1 : 0 : 5 mixture (crusher dust) 152
1 : 0 : 6 mixture (crusher dust) 153
1 : 0 : 7 mixture (crusher dust) 154
1 : 0 : 8 mixture (crusher dust) 155
1 : 0 : 1 mixture (trap rock) 162–165, 177, 178
1 : 0 : 2 mixture (trap rock) 156, 157, 166–169, 179, 180
1 : 0 : 3 mixture (trap rock) 158, 159, 170, 171, 181
1 : 0 : 4 mixture (trap rock) 160, 161
1 : 1 : 1 mixture (trap rock) 182, 183
1 : 2 : 2 mixture (trap rock) 184
1 : 3 : 3 mixture (trap rock) 185
1 : 0 : 2 mixture (trap rock and crusher dust) 172, 173
1 : 0 : 4 mixture (trap rock and crusher dust) 174
1 : 0 : 6 mixture (trap rock and crusher dust) 175
1 : 0 : 8 mixture (trap rock and crusher dust) 176
Plain, round columns, without reënforcement—
Neat cement 186–191
1 : 1½ : 3 mixture (trap rock) 192, 193
1 : 2 : 4 mixture (trap rock) 194, 195
Square column, reënforced with 4 twisted steel bars—
1 : 2 : 4 mixture (trap rock) 218, 219
Square column, reënforced with 8 twisted steel bars—
1 : 2 : 4 mixture (trap rock) 220–222
Round columns, reënforced with 2 hoops and 4 angles—
1 : 2 : 4 mixture (trap rock) 204–206
Round column, reënforced with 5 hoops and 4 angles—
1 : 2 : 4 mixture (trap rock) 207, 208
Round column, reënforced with 24 hoops—
1 : 2 : 4 mixture (trap rock) 209, 210
Round column, reënforced with 25 hoops—
1 : 3 : 6 mixture (cinders) 217
Round column, reënforced with 25 hoops and 4 angles—
1 : 3 : 6 mixture (trap rock) 215, 216
Round columns, reënforced with 48 hoops—
1 : 2 : 4 mixture (trap rock) 211, 212
1 : 3 : 6 mixture (trap rock) 213, 214
Round columns, reënforced with 48 hoops and 4 angles—
1 : 1 mortar (sand) 196, 197
1 : 4 mortar (sand) 200, 201
1 : 1 : 2 mixture (trap rock) 198, 199
1 : 4 : 8 mixture (trap rock) 202, 203
Square and round columns, reënforced with Hennebique type—
Square columns, with 4–¾-inch steel bars and 17 steel collars—
1 : 2 : 4 mixture (trap rock) 223–230
Square columns, reënforced with 4–1⅛-inch steel bars and 52 steel collars—
1 : 2 : 4 mixture (trap rock) 231–234
Round columns, reënforced with steel wire helix and 4 steel bars—
1 : 2 mortar (sand) 235, 236
1 : 2 : 2 mixture (trap rock) 237, 238
Round columns, reënforced with steel wire helix and 6 steel bars—
1 : 2 : 2 mixture (trap rock) 239, 240
Tabulation 241–243
Deduced results 244–258
Steel (Kahn) bars used in concrete construction, tensile tests .....

Page.
Concrete piles, compression tests 263–266
Copper band metal, frictional resistance tests of 61–69
Copper cylinders for pressure gauges:
  Tarage tables and examination of cylinders of pure copper and gilding metal, for 1/30 square inch gauges 71–84
Copper ingot, chemical analyses 90
Cordage:
  Tensile tests of hemp and manila rope for U. S. Light-House Establishment 105, 106
Eglentine metal:
  Bits, curb 49
  Stirrups 50
  Chemical analysis 50
  Tensile tests 50
Endurance shafts:
  Endurance tests—
    Amorphous steel 121, 122, 124
    Gautier steel 119, 121, 125
    Railroad rail head 120
    Sorbitic steel 123, 124
    Tabulation 126
Frictional resistance tests of copper band metal 61–69
Gun specimens:
  Mandrel tests of rings from 3-inch and 4.7-inch tubes and jackets 11–18
  Tensile specimens from fractured 12-inch naval gun No. 36 107
Lead cylinders:
  Compression tests of and experiments with 85–89
Mandrel tests:
  Rings from 3-inch and 4.7-inch tubes and jackets 11–18
Metallic fouling, chemical analysis 90
Monel metal:
  Bits, curb 48, 49
  Chemical analysis 60
  Tensile tests 52–59
  Tabulation 60
Paper:
  Blue-print and brown-print, tensile tests 373
Piles, concrete, compression tests 263–266
Piston rods, proof stresses 90
Posts, wooden:
  Compression tests—
    Cypress 356
    Douglas fir 355
    Pine, long-leaf 355
    Pine, short-leaf 355
    Spruce 355
    White oak 355
Pressure gauges, copper cylinders for 71–84
Private tests 374–376
Proof stresses:
  Piston rods 90
  Wire ropes and chain 90
Railroad material:
  Tensile tests—
    Steel rails from Mr. P. H. Dudley 111–116
    Tabulation 116
Resista steel:
  Chemical analysis 40
  Tensile test 40
Shot and shell:
  Tensile tests—
    Steel shell fired in round 91, 6-inch Crozier R. F. wire-wound gun No. 1. 19–22
Steel bars for comparison of testing machines:
  Bethlehem Steel Works 35–37
  Frankford Arsenal 30–34
  Watervliet Arsenal 24–29
  Tabulation 38

Page.
Steel (Kahn) bars used in concrete construction, tensile tests..... 261
Steel bits, curb..... 48, 49
Steels, miscellaneous:
Bending test—
Anchor bolt for gun carriage..... 41
Chemical analyses—
Armor plate..... 42
Barrel steel..... 42
Base spring steel..... 42
Bayonet steel..... 42
Bayonet catch steel..... 42
Bolt steel..... 42
Butt plate steel..... 42
Cocking piece steel..... 42
Cut-off sleeve steel..... 42
Ejector steel..... 42
Floor plate steel..... 42
Front sight stud steel..... 42
Guard steel..... 42
Knife steel for Hospital Corps..... 42
Rear sight base steel..... 42
Receiver steel..... 42
Resista steel..... 40
Saber blade steel..... 42
Sear and leaf steel..... 42
Sleeve steel..... 42
Upper band steel..... 42
Tensile tests—
Amorphous steel..... 40
Anchor bolt for gun carriage..... 41
Resista steel..... 40
Stirrups, Eglentine metal:
Chemical analysis..... 50
Tensile tests..... 50
Stone:
Chemical analyses—
Granite, Westerly, R. I..... 367
Granite, Greenville, S. C..... 368
Sandstone (Hercules), Washington..... 366
Compressive elastic properties—
Sandstone (Hercules), Washington..... 365
Sandstone, Tenino, Washington..... 363, 364
Compression tests—
Granite (A. J. Capron)..... 368
Granite, Greenville, S. C..... 368
Granite, Tishomingo, Ind. T..... 369
Granite, Westerly, R. I..... 367
Lithographic stone..... 370
Marble, Friedman, Ariz..... 369
Marble, Marble City..... 369
Sandstone (A. J. Capron)..... 368
Sandstone, Cherokee Nation..... 369
Sandstone, Chickasaw Nation..... 369
Sandstone, Choctaw Nation..... 369
Sandstone, Creek Nation..... 369
Sandstone (Hercules), Washington..... 366
Sandstone, New Mexico..... 369
Wheels for field carriages and limbers:
Description of tests..... 93, 94
Details of tests of wheels..... 94–98
Effect of tests on hub flanges and spokes..... 99
Tensile tests of scarf welded tires..... 100
Tensile tests of hub flange bolts..... 100, 101
Wire, steel:
Tensile tests—
For 6-inch Crozier wire-wound gun, experimental..... 44–46
Tabulation..... 48

Page.
Wire ropes and chains, proof stresses..... 90
Wooden posts:
Compression tests—
Douglas fir..... 355
Pine, long-leaf..... 355
Pine, short-leaf..... 355
Spruce..... 355
White oak..... 355
Compressive elastic properties—
Cypress..... 356

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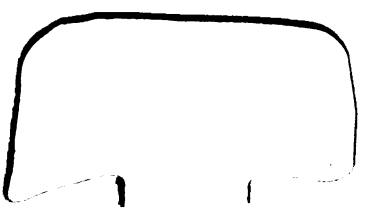
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